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# THE PRINTING ARTS

## An Epitome

OF THE

Theory, Practice, Processes, and Mutual Relations

OF

ENGRAVING, LITHOGRAPHY, & PRINTING

IN BLACK AND IN COLOURS,



BY

JOHN WHITFIELD HARLAND,

*Author of "A Manual of Shading Instruction,"*

*&c.*

WITH ILLUSTRATIONS.



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# Dedication.

TO THE REVERED MEMORY OF

MY FATHER,

THE LATE JOHN HARLAND, F.S.A.,

PRINTER, PUBLISHER, AUTHOR, EDITOR AND CRITIC,

THESE PAGES ARE INSCRIBED IN AFFECTIONATE REMEMBRANCES

OF THE FOSTERING CARE

AND INDULGENT ENCOURAGEMENT GIVEN BY HIM

TO EVERY RIGHT EFFORT OF THE AUTHOR

IN HIS YOUTH AND EARLY MANHOOD,

AND ACCOMPANIED BY A

DEEP REGRET THAT HE IS NO LONGER HERE

TO IMPROVE THEM BY HIS WISE COUNSEL, EXPERIENCE,

AND ADVICE.

*London*, 1892.

# PREFACE.

THERE are two principal reasons for the appearance of this little book on the most potent of the industrial arts of reproduction.

The main intention of these pages is to impart to workers, and above all to apprentices, some technical knowledge of other branches of their craft than their own, and to impress upon them that to do good work demands an intelligent knowledge of the technique of after-processes to render it fully useful and purposeful.

Bad workmanship in the foundation renders the superstructure, however well done, insecure; every error in the commencement is magnified in the completion, and entails double expense in attempting to correct it. Thorough knowledge of the way in which our work will be carried on when our part is completed by others, tends to the avoidance of any error that would entail extra trouble on them. On the other hand, in the completion a practical knowledge of the system by which the earlier stages have been performed, gives clear insight into what is still left

to be done, and into the best means of correcting any incipient faults.

The secondary object in view is that of imparting sound views to those who, in these days of limited companies, invest money in any of the branches of the Printing trade, in order that they may judge of the value of prospectus promises *before* investing, and of the capabilities and management of the concern and its employés *after* purchasing shares; to give, in short, sufficient insight to those who know literally nothing of such businesses as will protect them from inevitable losses.

THE AUTHOR.

# THE PRINTING ARTS;

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OF THE

## Theory, Practice, Processes, and Mutual Relations

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## ENGRAVING, LITHOGRAPHY, & PRINTING

IN BLACK AND IN COLOURS.

### CHAPTER I.

Introduction — System of Arrangement of a Letterpress Printing-office—the Composing-room—the Machine-room—Lift for Forms —Safe Keeping of Blocks, &c. — Construction of Blocks for Poster Work—Apparatus for Washing Forms and Ink Rollers —Store for Ink, &c.

N the following pages, it will be our aim not so much to give separately, for each branch of the trade, useful hints interesting to one branch alone, but rather to present, in every chapter, facts and information of interest alike to all connected with the Graphic Arts. In explaining, for instance, the principles which should underlie the arrangement of a letterpress printing-office, others who are not connected with this branch will find hints that apply equally to lithography. The advantage which the writer hopes to gain by this plan is, that all readers may be equally interested in the several articles, instead of finding only an occasional chapter suited to their special requirements. Information will thus be afforded that must be useful indirectly even to those not actually engaged in the branch treated of, as the various

trades are intimately connected with, and inter-dependent one upon another. Many persons are apt to ignore the fact that the knowledge of a business or process not their own, though often auxiliary, may be of great use to them in their avocation, enabling them to do their work much more intelligently, by making them conversant with the true principles that have guided others whose work has preceded or will follow their own; and they will thus be enabled to dovetail, as it were, one part with another into an harmonious whole.

The arrangement of a printing-office is one of the most important matters for consideration, as upon it depends the future saving or waste of time of those employed, the capabilities of the office to turn out work well and rapidly, and systematic order or chronic disorder and confusion. It might be said with truth that upon the careful planning of an office depends the actual success of a business, for, if it be badly arranged, the profits will soon be swallowed up; and this applies equally to lithographic and to letterpress printing-offices. If we follow in imagination a job through its various stages, from its entry to its delivery, we shall at once realise the importance of a thoroughly practical and intelligent arrangement. As letterpress work is usually more rapid in its progress through the office than lithography, being capable of a wider subdivision of labour, it will illustrate the principle of arrangement more fully if we commence with this branch. The entrance to the composing-room is the natural place for the overseer's desk, although exceptions to this rule are numerous. If, for the sake of being central, or with the object of having a commanding view of the whole composing-room, it is placed far from the entrance, it must be evident that a disturbing element is introduced by the passing to and fro of persons who ought not to be permitted to pass beyond the desk, to the inconvenience of the men at work, thus causing confusion and loss of time. The arrangement of cases and frames must, of course, largely depend upon the special requirements of the business. The cases which are most frequently in use or are likely to be put into constant requisition should be nearest to hand. Beyond them should be the frames which are more seldom used, and the racks for wood letter

and larger types for poster-work. A convenient plan would be to have the racks for chases and forms on one side of the room, and the shelves and racks for poster type along the other. The imposing-tables should be so placed as to be almost equidistant from the majority of frames, as central, in fact, as possible, with sufficient floor space around them to allow of the men passing freely without running against each other. Of course, the cases for leads, quads, furniture, &c., should be as handy to the imposing-tables as can be managed, and contiguous to the racks for forms, and to the entrance to the machine or press-room. The reading-closet, we think, should be placed alongside of, but screened from, the overseer's desk, with openings for passing in proofs. Frequently points of doubt arise, when the reader has to inquire from the overseer, and, if the desks are contiguous, he can put questions without leaving his seat.

No absolute rule can, of course, be laid down which will meet the requirements of every office, because the exigencies of one business are not those of another; but, if ordinary intelligent forethought be exercised, and the plan be followed of placing everything so as to avoid as much as possible having to run hither and thither, the gain of time in a month or year will amount to something considerable; one additional footstep, oft repeated day by day, will, in time, represent, in a large office, the weekly wages of several men. If, as is frequently the case, the machine-room is situated below the composing-room, whilst the presses are either in an adjoining, or at one end of the same, room, a lift for forms should be conveniently placed near to the imposing-tables, so that the forms can be readily placed in the cage for descent to the machine-room, a clear passage being reserved for taking forms to the presses. If the lift be made with two cages, back to back, one to descend whilst the other ascends, then one side can be used for forms that have been worked off, whilst the other takes down a form to be worked; in such a case the weight of one will almost balance that of the other, and thus save power.

In small jobbing offices there should be behind the overseer's desk a cupboard with sliding doors, containing shelves and drawers, some of which should be set apart entirely for electrotypes and woodcuts. In larger offices

the storekeeper will, of course, take charge of these. A word here, that experience has taught is not unneeded. By far the larger number of printers and storekeepers do not seem to be aware that woodcuts should never be laid flat, but be placed on edge: the reason is, that, as they are cut on the end grain, they are likely to warp, and also that, if the face is uppermost, the slightest thing will injure them; whereas, if they are arranged on edge, the face is protected by the back of the adjacent block, and the wood will never warp, nor is it so likely to crack if the room becomes over heated. A cool, dry place is essential if warping and other damage are to be avoided.

Blocks for posters being cut plankwise, should also be laid on edge; they should be placed in racks, with the grain running perpendicularly, not horizontally; because, if the grain runs in the direction in which the tree grew, it will not warp. These blocks are but seldom made as they ought to be, a cause of great loss of time and annoyance to the machine-minder. If, say, a quad crown (40 in. by 30 in.) block is ordered, the maker usually puts the grain the 40 in. way, and when it is placed on the machine-table the grain is along the cylinder, so that, at every successive impression, the block is being bent gradually, but effectively, and by-and-by the quoins are loosened as the edges rise, and are forced down again at each run by the cylinder. The block should be made 30 inches long and 40 inches wide; the grain, being then at right angles to the cylinder, will effectually prevent the block curling, and the quoins will not rise. Printers who often work blocks will find it economical to clean them after printing with raw linseed oil instead of turpentine or petroleum, as the oil soaks into the wood and hardens and preserves it. The machine-minder should, before lifting, run a few waste sheets through without inking, to free the blocks from ink, and then clean the sunk parts with oil and a rag, or, better still, with a brush—not a "lye"-brush, be it remembered.

In the machine-room the arrangement of presses, &c., is decided by the shape of the room; but there is one important point, and that is, its relative position with regard to the warehouse, so that the unnecessary labour of carrying every ream of paper any distance may be avoided. In

a large concern it is recommended that the warehouse itself should be separated into two—one portion being for unprinted paper, and the other for the work when machined, with the machine-room between the two. The paper being delivered from the street is stocked, and whatever is required is given out to the machines, and, after printing, it is simply passed out at the other end of the machine-room to be counted, cut up, stitched, perforated, folded, or whatever subsequent process it has to undergo before being packed and sent away. This arrangement will be found to prevent confusion, and will permit of the use of a labour-saving contrivance consisting of an endless band always moving along from the paper-warehouse to the stock-room, upon which the paper is laid and travels along until it arrives at the machine for which it is intended, when the minder lifts it off on to the feeding-board, and places on the moving-band the finished work he has completed, which then travels out into the "stock" or "counting-room."

The machine-room would be incomplete without—either just out of it or in some convenient corner, preferably near the lift—a sink for washing forms as they come off the machine. There is no question that the most perfect means of cleansing type is the steam jet. This consists of a steam pipe fitted with a universal joint and a small nozzle, fixed so that by means of a wooden handle the nozzle can be directed to every part in turn of the form to be cleansed, and by means of a stop-tap the steam can be turned on or off at pleasure. The steam, impinging upon the inky form at a high temperature, and with sufficient pressure, first loosens the grease, and then blows it out of the very smallest interstices, leaving the type, the furniture, and the chase quite clean. The whole is done in a few seconds without lye or brushes, and there is no loss of time, while the oxidisation of the type is also avoided. A compositor can distribute type thus cleansed as quickly as if it were new, without soiling his hands. If judiciously used, the steam jet will not injure even a fine woodcut, provided it is immediately wiped dry and very sparingly oiled with raw linseed oil; and, as regards zinco blocks and electros, steam cleanses them perfectly. Even where the motive power is a gas

engine it will pay large concerns to fit up a steam generator expressly for the above purpose.

Composition rollers, if at all old and hard, are improved by being subjected to the steam jet, but they ought instantly to be placed under a cold-water tap. Holes or cracks in them are thoroughly freed from ink or colour by this means, and their suction capacity is renewed. Of this any one can convince himself, by subjecting a small hand roller to the process by holding it over escaping steam.

Another absolute requisite of the machine-room is an ink magazine, or small warehouse, whence can be readily given out the various inks and colours required for each job. The plan of leaving a can of ink under the machine for the minder to "slobber" on, is wasteful in the extreme, and productive of two great abuses. Firstly, too much ink is used, and much more is wasted, through inattention, allowing the air to dry the ink up into "skins"; and secondly, by adopting this plan, the proper quantity of ink used cannot be debited as it ought to be to each job. To test the accuracy of this remark, any one in the habit of estimating for coloured poster work has only to remember how often he has been obliged to merely guess the probable quantity of ink that a given job would require, only to find afterwards that his estimates had fallen a long way short of actual consumption.

In France the writer found that a great saving in ink and colour for large posters was effected by giving out to the "conductors" of machines (as they are there called) a fair amount for each job, and offering a commission on all that was brought back, a watch being kept, of course, upon the copies printed to see that they were properly covered. The cans returned were well looked after, so as to prevent "skinning," and with clean water poured on were put away on shelves labelled, till again required, the weight having been taken and the amount used properly entered in the cost-book to the debit of the job, thus forming some guide for future estimating.

We have seen that the machine-room arrangements should comprise a store for paper, a store for ink, a store for finished work, and provision for cleansing forms and rollers; there remain, however, three more desiderata to

be mentioned, viz., good lighting, good ventilation, and sufficient passage-room between the machines. Good lighting is a necessity for turning out good work, either in black or colour; good ventilation,—that is, constant change of the atmosphere without currents of air blowing the sheets about, so managed as to maintain one unvarying temperature,—is as essential as good light, where good register is hoped for; and room to move about, without getting into other people's way, is no less an absolute requirement.

Wherever a large number of machines are running, a system of control over the minders is necessary. The foreman superintending should make a rule that until the "making-ready" is properly finished, and a first sheet signed, either by himself, or, in the case of colour work, by the artist or engraver, that the minder is not to commence running. The best position for the desk of the machine-manager is, if the height of the room permits it, in a sort of gallery high enough to enable him to overlook all the machines at a glance, and whence he can readily call any "minder" to give him instructions, &c.

## CHAPTER II.

Arrangement of a Lithographic Printing-office—The Artists' Room—Convenient Modes of moving the larger Stones about—Offices where both Letterpress and Litho Work are done—Hints as to Heating, and as to Floor Levels—Fire Appliances and Fire Drill.

HAVING in our last chapter shown how necessary it is to give due consideration to the general arrangements of a Letterpress establishment, we will now proceed to point out what are the most obvious requirements in a Lithographic printing-house. Although at first sight it might appear that an entirely different system would have to be adopted, yet a little reflection will show that we can deduce, from what has gone before, sufficient to guide us in the planning and organisation of a lithographic establishment.

The guiding principle should be the same as that laid down for the letterpress department, namely, to contrive that every job shall pass over as short a journey in its progress from one stage to another as possible; and, as the weights to be moved are much greater in proportion as compared with letterpress, and therefore slower in transit, it becomes evident that attention to this principle is in this case of even more importance than in the other. Following a job through its career, we have, firstly, the stone-grinding and graining; and thence the stone will be passed, either to the artist to be drawn on or to the hand press of the transferrer. The relative positions of the artists' room and the hand-press room should be side by side, and as near the stone-polishing room as possible; because, when the artist has finished his drawing, be it ink or chalk, the stone before being sent to the machine must be first etched and cleaned, washed out, and carefully rolled up, and usually *proved* at hand press, the proof being then submitted to the artist or to the principal in charge of the room.

The essentials of the artists' room are, firstly, a good *north* light, an equable, healthy atmosphere, freedom from currents of air, absolute cleanliness and comfort, and last, but not least, it should be so situated as to be unaffected by either the noise or the vibration caused by the machines at work. The benches should be strongly built and braced so as to be firm and solid, and placed with their left-hand ends towards the light; they should slope sufficiently to enable the artists to obtain a good view of the whole surface of the stone, without having to bend over it too much; and at the back of the bench there should be a rail high enough to hold the various copies upright in front of the artist. The several benches should be sufficiently wide apart to admit of stones being brought in and put up before each artist, without disturbing or shaking the other benches, and to permit the manager to walk round to give instructions, or to see how the work is progressing. Each artist should have beneath the bench a drawer for his instruments and other requisites, proofs, &c. It is usual for the artists' room to be situated at top of the house, where good light is secured, while, at the same time, it is away from the noise and vibration of the machines; but, if so, there should be a lift for raising and lowering the stones, or great loss of time will result.

It is customary to have a sort of trolly to put under the edge of a large stone for the purpose of moving the same, but we would recommend as a far greater time-saving appliance a "turtle carriage," constructed as follows. A strong frame, capable of supporting a load of five or six hundredweight, is mounted on three small iron wheels, with india-rubber tires, the single wheel being placed at one end and the other two facing at the opposite end. The single wheel should be made to swivel, tricycle fashion. Instead of having a top upon the frame like a table, four or more rollers in bearings are fixed transversely, so that a heavy stone can be readily pushed on to or off it when required, the upper sides of the rollers being higher than the frame, but so arranged that they can easily be lowered by means of a lever, in order to leave the stone bedded upon the top of the frame itself and its cross-bars, and thus prevent its slipping on the rollers during transit. The frame

should be a trifle higher than the side frame of the litho machine, the artists' benches being made of the same height, viz., 3 ft., which is also about that of a quad crown hand press. When laid flat upon this carriage, the stone can be easily pushed along, run into the lift and out again, or alongside of the artists' bench, on to which it can be slipped without any lifting. When the drawing is finished, the carriage can again be brought into requisition, and so on during subsequent operations. The common trolly necessitates the stone being held upright, with the lower hindmost corner dragging along the floor, thus rapidly wearing out the boards, besides causing noise and vibration in the artists' room, and inter[illegible]n to those at work, every time a stone is brought up [illegible].e loss of time in three liftings and lowerings, the [illegible] of the artists' time in stopping work as the ston[illegible]pass along, and the extra number of labourers requ[illegible] to lift and lower, far outbalance the extra cost of t[illegible]riage here described, whilst, moreover, the carriage i[illegible]r and less liable to cause accidents. If thought de[illegible]e, the same movement that lowers the transverse rollers [illegible]uld also be made to raise stops at the edges of the stone, in order to prevent all possibility of its slipping off.

In some offices the stones are slung by a chain from a sort of travelling crane upon overhead rails, raised and lowered by a rope passing over differential pulleys, this being the plan adopted at the Strobridge Printing Works in Chicago, United States, where, the principal work being posters, the majority of the stones employed measure 40 in. by 30 in. We think, however, that, taking cost and other things into consideration, the turtle carriage is more economical both in time and labour, as well as more convenient where the rooms are not all on one floor.

In offices where both letter-press and litho work are executed on the same premises, it is advisable to keep them separate and distinct; and, where engravers too are employed, their rooms should be contiguous to the department for which they work—*i.e.*, wood-engravers nearest to the letterpress department, and copperplate engravers next to the litho-artists' rooms, so that there might be no time

wasted in proof-taking and making the necessary offsets for the colours.

It should also be remembered that, in dealing with a substance such as paper, especially where colour work is attempted, an equable temperature is an absolute *sine-quâ-non* to insure perfect register. It is, therefore, advisable to place thermometers in central positions, and the ventilation and the heating should be regulated carefully, so as to maintain one regular standard heat—say, 75 deg. Fahr. At this temperature workmen are prevented neither by cold in winter nor by heat in summer from performing a good day's work. It is, moreover, sufficiently high to prevent paper expanding from damp, to dry the colours without taking away from their purity or brilliancy.

In many printing-offices where success in business has entailed an extension of premises, it frequently happens that the next house to the original office is secured, and doorways have to be opened through a party-wall. There is one consideration which under such circumstances, ought to be carefully noticed, namely, the respective heights of the corresponding floors of the two buildings. At first sight, having to descend or ascend one or two stairs from one floor to the corresponding one in the next house, may not appear to be of much importance; but, if it be remembered how often this extra labour of a few seconds' duration has to be repeated by every one passing up or down in the course of a year, or series of years, it will be evident that, wherever practicable, it would be cheaper by far, in the first instance, to re-floor one or other building, so as to make both flush with each other. The same consideration should influence the construction of staircases, which, if too narrow to permit two persons to pass with parcels, will often entail serious delay by causing one of them to draw up to one side to allow the other to pass; and, on the same principle, gangways and passages should be kept clear of all packages and other obstructions.

There is another and a paramount reason for avoiding difficulties in moving freely about throughout the premises, and that is when there is danger of fire. People getting into one another's way may impede exit and cause a sacrifice of life, or prevent the instant use of means to extin-

guish the fire before it makes headway. Staircases to some extent, and the wells of lifts in a still greater degree, may be regarded as chimney flues, through which the flames are carried upwards by the current of air, as in a furnace, and they should, therefore, be so constructed that, in case of fire, they can readily be cut off entirely from the various floors. Where standpipes, hose, and fire buckets, or other appliances are provided, their efficiency ought to be thoroughly insured by a frequent "fire drill" amongst all hands, so that each man should know his proper station, and what his expected duty would be; by which means, aimless, and therefore fruitless, labour and panic in the hour of real danger might be avoided. The employer would gain by allowing time for this, and the *employés* might often avert the risk of being suddenly thrown out of employment by a fire which, if promptly subdued by each one intelligently knowing and doing his duty, would cause but little damage, to say nothing of averting the danger to life and limb

## CHAPTER III.

Travellers for Printing Orders—Competition—Modes of Payment, Disadvantages of Commission as payment—Sketches *gratis*—Traveller's record of Calls.

HAVING glanced in the two previous chapters at the economic interior arrangements of the Printing-house, we may now say a few words concerning the important outdoor arrangements for obtaining work. Personal canvassing by the proprietor or a partner, or by a good traveller, is almost indispensable in these days of keen competition, and a few practical remarks on this subject will be useful. Whenever possible, the best course to pursue is to intrust this share of the work to a partner, provided there be one, in preference to employing a traveller,—firstly, because he can decide where a traveller must frequently refer to the firm, thus risking the loss of an order; and, secondly, because, if the traveller works up a good trade and demands higher remuneration, the firm is entirely at his mercy: he can leave and take the bulk of the work away with him, either to a rival house, or he may start a business for himself. Other minor reasons are that, whether paid by salary and expenses, salary and commission, or commission alone, there is a constant temptation to the traveller to undertake work at too low a price rather than lose the order, especially if he be paid by commission only. There is yet another danger. In estimating, very frequently the traveller on commission, rather than refer back to the firm, offers to share his commission with the person who has the placing of the order; and the result is that unfair conditions are imported into what it is the true interest of all in the Trade to make a thoroughly legitimate competition. Under-cutting, whether arrived at by sacrifices on the part of the traveller, or using inferior material, or by lowering wages or piece-work prices, is false political economy, and

must result, in the long run, in reduction of profits. Hence two unsound maxims, which are often quoted to soothe a master's commercial conscience, ought to be expunged for ever from the Printing Trade, viz., "Half a loaf is better than no bread," and "Set a sprat to catch a salmon." The former means too often that, not only a half, but a third, a fourth, a tenth, or even a crumb, is better than nothing; but where is this to end? Again, whilst it is true in the abstract, so far as it goes, it necessitates the completing question, "But at what price?" No bread for which one does not have to pay is better than a crumb that one pays too dearly for. The latter means that a job is taken at a price that entails a loss in order to obtain at some future time a job that will pay well enough in itself to cover the loss on the first, and leave a profit on the second. This is unsound because the salmon may never be hooked, and then the loss remains a dead loss; and further, because it is sure to be quoted as a basis upon which to compute the value of future work, not only to the firm immediately concerned, but also to competitors; and thus this system opens the door to a general reduction of prices all round. Again, people who have frequent printing orders to place often know enough of the business to enable them to compare the relative prices of different jobs, and to detect the proportionate difference in the quotation for the first "sprat" and the subsequent good fish. Nor does it end here. The more this is done the more hardened does the commercial conscience become; and, forced by the loss of quite a shoal of "sprats" to earn a dividend at all, the firm is gradually compelled to lower wages, use inferior materials (which, be it remembered, are often delusive as to actual cost), supplying short counts, and other dishonourable commercial practices, ending, at last, as such unfair competition deserves to end, in failure and disgrace. Admitted that self-denial is often strained in resisting the temptation to book an order at almost any price rather than lose it, such self-denial brings its own reward in the comforting certainty that there is a legitimate profit upon every job that goes through the house, and that, even if the business is rather limited, it is all sound; and that, in this sense, it is true that "half a loaf is better than no bread."

If a traveller be employed, it is better to pay salary and commission than commission only, firstly, because he thereby becomes a servant (in law) and must obey the instructions of the firm; and, secondly, because, if an order has to be declined owing to the price not being good enough, he cannot plead that he is debarred from receiving payment for his trouble in going after the order so declined; no injustice is done, as his salary provides for such cases. Care should be taken, in fixing commission over and above salary, not to confer on the traveller any specified proportion of profits unless the intention is to take him into partnership, as, legally, such share of the profits would constitute him a partner. An agreement would avoid this difficulty if his commission were specified to be upon the turnover, or upon all business above a certain fixed amount of turnover. We have known cases where this legal technicality has been turned to account by the traveller, much to the surprise of his employers. There is a rule which ought to form part of the system of every printing-house, and the want of which causes much confusion in connexion with travellers, namely, that all orders booked should be executed in their proper sequence, unless there be special reason for a contrary course. It is, of course, natural that the traveller interested in his own work should be anxious to have his customers' commands executed as quickly as possible, especially as he poses to his customer as one in a position to see everything done specially as the latter wishes it. The "leave-that-to-me" suggestion hints to the customer that his order is likely to have the attention of the traveller during its progress, and binds him to remember this attention when next he has an order to place. This is quite right, but the traveller should remember that other orders besides his own come in under similar promises made in the office, and the precedence given to either would lead to confusion and disappointment. All orders should be, of course, executed according to the specified time for delivery; but, if this is impossible, the rotation of their being booked should decide their sequence.

There are several unfair customs which have crept into the Printing Trade, that are directly traceable to the natural eagerness of travellers to do business. One of these customs,

which has become quite general, is the pernicious one of submitting sketches, free of charge, to the customer, on the understanding, that if he gives the order the sketch will be included at the price estimated, but, if not ordered, no charge will be made. The result is this, that the traveller, being anxious to get an order, promises a sketch, very often when there is but a hazy prospect of business; then, the more uncertain he feels about getting the order, the more wishful he becomes of having a first-rate sketch, relying on the effect of submitting something that will "fetch" the order. Besides, he knows well enough that other travellers are almost sure to drop in and get wind of it, who will also offer to submit a sketch on the same terms, and this makes him doubly anxious to submit the best: hence time, money, and talent are all thrown into the balance at the expense of the firm, who are actually committed, without any choice in the matter, to "set a sprat" to catch very often, not a salmon at all, but a fish of very questionable value. There is, we are afraid, no remedy for this state of things now; the travellers (the middlemen of the political economists) have created a system to which nothing can put a stop short of an agreement among all the printing-houses not to submit sketches without receiving payment for same.

As matters stand, any one, for instance, who requires a good artistic show-card, but does not really know what he wants, has only to let the fact ooze out to the trade, and, lo! twenty or thirty travellers offer to send in designs. These designs, often real works of art, varying in value from £5 to £20, are submitted, and, in the end, one is, perhaps, selected, executed, and delivered at a cost to the purchaser of, probably, less than the aggregate cost of the designs alone! Can it be pretended that this is fair competition? Is it not time that by means of combination employers in the Printing Trade should mutually agree not to continue to uphold out of their own profits a system as ruinous as it is unfair?

In architectural competitions, the parties requiring designs offer premiums for the best one, if they desire to have a choice, and there is some degree of fairness in such a competition, frequently the second best and third best securing

minor prizes; but the only prize in artistic printing is, that *one* obtains the order, and very frequently at a price that scarcely pays, whilst all the others lose.

The various workmen,—the artists, the compositors, the letterpress and lithographic pressmen and machine-minders, the stationers and binders, &c.,—have combined in Trade Societies to protect themselves, and their employers are, perhaps, indirectly benefited by their union; but the employers, as a body, continue as disorganised as ever. Employers' associations seem to be liable to die out almost as soon as formed, yet there can be no doubt that they would be of immense benefit to the trade in putting a stop to abuses, if they could only manage to cohere and act loyally in accordance with their true interests. The causes for the prevailing state of things are not far to seek:—trade jealousy and want of trust and confidence in their competitors, as well as personal objection to submit to any control or self-denial for the common good, which they are unable to see cannot be secured in any other way.

On the other hand, the system of competition protects the public from imposition and from exorbitant charges, the use of very inferior materials and bad workmanship, because other travellers are sure to call who have sufficient practical knowledge of the business to point out any defects, and to quote a price for a similar article, with this advantage on the side of the new estimate, that the result is before him in a defined and completed form, thus giving him the exact result to estimate for, which, in the first instance, was probably not the case, and therefore involved some amount of guesswork. It is quite true that there are many travellers who abuse their privileges, and run down the work of all rival houses; but, as people are sure to take a liberal discount off a traveller's assertions, such gentlemen, as frequently as not, defeat their own object by an indiscriminate resort to this practice. A wise traveller will express no opinion of other people's work unless he is pointedly asked for criticism, and even then it is better to be guarded, because every house is liable, at times, to turn out an inferior job, and his own firm might possibly deliver just such a one to the same customer at a future date, and it would be a little awkward to have his own

remarks quoted to him in reference to such work. Candour and fairness predispose people to expect fair dealing from the traveller who uses arguments under such influences, and nine times out of ten, even as a matter of policy if not upon principle, such a line of action will be found, in the long run, to be a more successful one.

From the foregoing remarks it will be evident that a very great deal of the success of a business, all other things being equal, depends upon the choice of a thoroughly competent and reliable traveller, more especially when upon his discretion must rest, in most cases, whether or not the expense of sketches on "spec." shall be incurred by the firm. Nor is this the only abuse to which he is, or pretends to be, reluctantly compelled to be a party. New-year's gifts, presents, and other means of obtaining orders from *employés* of firms amount really to a heavy pecuniary drain upon the profits of a business which are already quite enough reduced, under ordinary circumstances, by keen, and often unfair, competition. We do not say that any one firm can put down their foot on such practices; they would not be strong enough alone to make any appreciable difference in the existing state of things, and might really lose by resistance; but this is only another reason for joint action and combination amongst printing firms. What no single firm could effect, the united voice of an association could, however, stamp out, if they persevered.

One reason often urged for paying a traveller commission only, is that whilst out there is no check upon his movements, and that, for anything the firm know to the contrary, he may be wasting his time instead of doing his duty. There is, however, a very easy and effective way of preventing this occurring, which has other very great advantages. Let the traveller be required to enter up, every night before leaving the office, in a book expressly kept for that purpose, every call he has made during the day, with the replies to his applications for orders, and such future appointments as he may have made. A daily record such as this, always accessible for reference by the firm, will give an idea as to whether the traveller is idling his time away, whether his appointments are attended to or neglected, and, if suspicions are aroused that he is making false entries,

one or two personal calls will test the accuracy of his record. If the firm find he is calling upon undesirable houses, an intimation to him prevents his doing so again. And any item of information which the traveller himself may possibly not be in possession of is sure to be given him. Nor is this all; in cases where a traveller has called upon a house not previously a customer, and the order is sent direct to the firm, the fact of his several calls being put on record decides the claim to a commission upon such orders; if they are not recorded, then no such claim can be entertained, thus narrowing the chances of unpleasant disputes occurring, and subsequent feelings on either side that injustice has been done. Again, in case the traveller is absent from ill-health or other causes, the traveller's record gives a clue to be followed up, that no chance of missing an order by neglecting to call at appointed times may be lost; and, in case he is discharged or resigns, his successor has a clear idea of expectations of orders to come, and can thus follow up his predecessor's work with hopes of success. The extra half-hour necessary to write up daily this record is a positive gain to the traveller himself, as nothing conduces so much to a good system of working as putting the day's work into writing. It improves the memory, and daily reference to past memoranda prevents any appointments being forgotten.

## CHAPTER IV.

Motive Power—Coal Supply—Relative Value of Gas-engines and Steam-engines—Circumstances under which one or other should be Chosen—Defects in Cooling Apparatus for Gas-engines—Economy of Fuel in the use of Steam-engines—Heating by means of Waste Steam—Suggested Improvement in Cooling Gas-engines—Insuring Boilers—Indicating the Power of Engines—Richards & Darke's Indicators—Shafting, &c.

DURING the past few years it has been pointed out by practical geologists that our coal supply is being exhausted at an ever-increasing rate, and that, at the present progressive annual output, we shall, ultimately, either have to import coal or discover some other means of producing motive power, either in the form of a substitute for coal as fuel, or as an entirely new motor actuated by some other force than steam. The late Thomas Binney, and subsequently Professor Jevons, have published tables of statistics, showing precisely at what ratio we are exhausting this factor in the great question of national wealth. As these estimates, carefully calculated by two independent men who have made the subject a special study, do not vary to any great degree, it may be taken that they are approximately correct. The chief cause of this immense output of coal is, of course, the demand for steam-producing fuel; and, curiously enough, every invention of these latter days,—such, for instance, as electric lighting,—only adds to the demand for and use of more steam. So long as the electric light was obtained chemically it was too expensive, but the moment a motor was substituted for the battery the expense was reduced, and the consumption of coal increased.

Then, again, the gas-engine, rivalling to some extent the steam-engine, depends indirectly upon coal for its power. What is wanted now is a motor that will dispense with coal entirely. Are there no engineers who will take up and solve this problem? It will have to be solved when

the coal is all exhausted. Petroleum has been suggested and tried with partial success; but here, again, as this fuel is no more inexhaustible than coal, it will in the future come to an end. If some other product could be found which, by some process of conversion, might be made to serve for the manufacture of gas for feeding engines as cheaply as, or more cheaply than, gas from coal, a step in the right direction would have been taken. There can be no reason why an expansive and, at the same time, explosive gas should not be substituted for light carburetted hydrogen for this purpose.

There are several weighty considerations to be taken into account before one decides which motor shall be adopted —gas-engine or steam-engine; and a few of the most important may usefully be glanced at here.

In the first place, if the exigencies of the work only require machines to be run occasionally for a few hours at a time, as in the case of a bi-weekly or weekly paper, perhaps a gas-engine is the most convenient and economical of the two, because it costs nothing when at rest and also works much better when going, if it be not run every day for a number of hours. If, on the other hand, there is constant work, week in, week out, a properly-regulated steam-engine is best and cheapest. It does not use more water than a gas-engine of equal power, the fuel costs less than the gas, an attendant can more easily manage it, and, as it is more certain in its action, there is a great saving in stoppages. After a gas-engine has been running many hours, the working parts become hot and expand, and it begins to stop or run spasmodically; the tanks, instead of containing cold water to cool the cylinder, begin to boil, and often, just when a press of work occurs, the engine will not run at all, whilst its power varies with circumstances. The great difference of principle between the two is this, the gas-engine is actuated by a disjointed series of explosions, producing fouling, like a gun, and overheating, which means greatly-increased friction; whilst a steam-engine is kept in motion by a regular force acting alternately in front and behind the piston, and scientifically arranged, so that the steam, when the rush into the cylinder is stopped, still acts by expanding until the end of the stroke, when the

same thing commences and is repeated in the return stroke, a perfectly mechanical and direct action being sustained throughout. By increasing the pressure of steam its elasticity increases, its power of expansion is greater, and the engine will perform more work. There is no concussion, as in the gas-engine, no fouling, no increase of friction, and no extra heating. If the valves of an engine of eight or ten horse power be set so as to cut off at one-fifth of the stroke, and the boiler is on the latest principle, the fuel consumed, with intelligent firing, per horse power per hour ought not to exceed from 2½ to 3 lb., and in larger engines the quantity should be even less ; and this is capable of being kept up night and day for weeks, whereas no gas-engine can go on running for any length of time without intermission.

Again, it is necessary to have some means of heating the printing-house during the winter, the importance of maintaining regular temperature being self-evident. The waste steam, or "exhaust," from a steam-engine forced through pipes circulating through the rooms will effectually suffice for this object, at absolutely no further cost beyond the outlay for the pipes. Of course, there is the inconvenience of getting rid of cinders, but it is more than counterbalanced by the sureness and certainty of action as compared with the uncertainty of a gas-engine.

It is true that, in properly-arranged tanks for cold water for gas-engines, the inconvenience of their boiling (before referred to) may be remedied to a great extent, though we do not remember to have ever seen this arrangement tried. If two cisterns be placed at the top of the house, one for cold water and the other for hot, and the cold-water tank close to the engine be connected by a circuit of pipes, one running to the *bottom* of the tank direct from the cold-water cistern above, and one running from the *top* of the tank to the hot-water cistern above, the radiation of heat will always keep the water in the tank cool ; of course, it must be understood that the tank is a *closed* one, and if the circuit of upcast pipes be taken through the rooms the waste heat may be, to some extent, utilised, though very unequally, as the upper floors will always be hotter than the lower ones. This is a very good plan to avoid the over-heating of the water in the cooling tank, and is, in fact, the

same apparatus on a larger scale as that in common use for heating water for bath-rooms in dwelling-houses, so that, at the mere cost of the circuit of pipes, the gas-engine will not stop for want of cooling. There still remains the fouling, and, this can never be entirely overcome ; but, if the engine be very frequently cleaned in all its parts, the effects of fouling may be much modified. If attention be not paid to this, a gas-engine is a constant nuisance and source of expense.

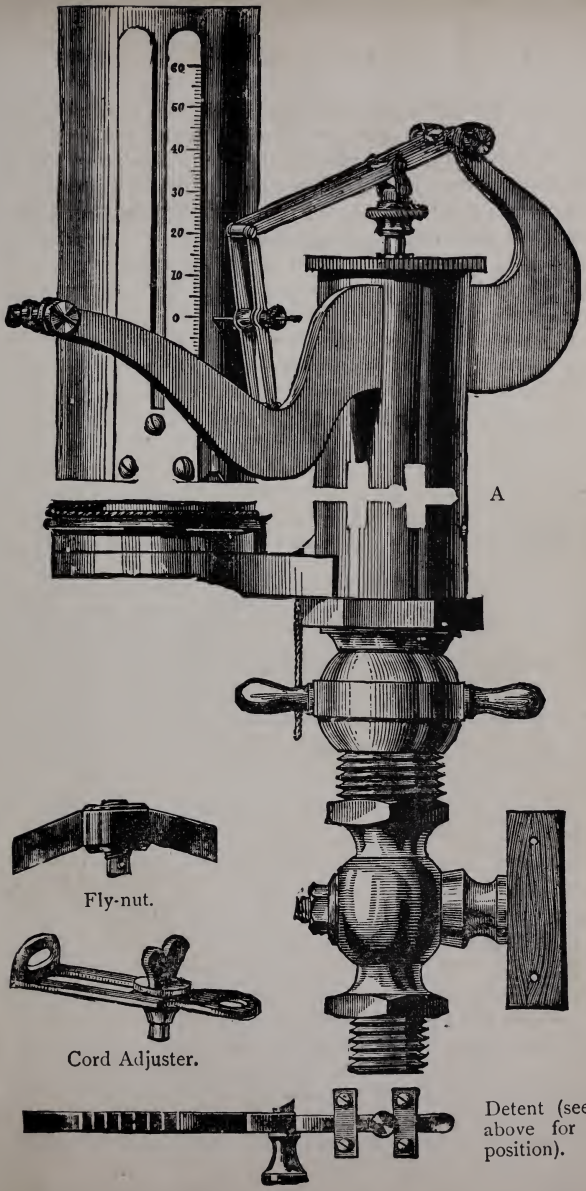
If a steam-engine be decided upon, it is a duty incumbent upon the firm to insure the boilers, which precaution not only covers any probable loss but, what is of far more importance, insures a regular periodical inspection by competent men, and thus safeguards the lives and limbs of those employed. A flaw may pass unnoticed for a time if the often incompetent inspection of the attendant who cleans the boiler is the only check.

As to the engine itself, a saving in fuel will accrue from frequently "indicating" the cylinder, as it is called. Any one can perform this simple duty, which consists in obtaining, by means of a steam-engine indicator, a diagram of the "diagonal of forces" during one revolution of the engine. By diagonal of forces is meant the line which is the mean between two forces acting in different directions ; but this diagonal may not be a straight line, and in an engine indicator is not, but consists of curves, as it also does in what is called the "trajectory of a projectile," as when a bullet is fired at a certain angle, if it continued its course at one unvarying rate of speed, and no other opposing or influencing force actuated it, it would describe in its flight a straight line ; but, as the resistance of the atmosphere, the inertia of matter, the force of gravitation, and the decreasing ratio of the initiative force of the explosion all combine to modify the diagonal, a parabolic curve is the result. In a similar way the transit of the piston during the stroke, from one end to the other of the cylinder, instead of being a straight line, is influenced by the force of pressure of steam, also by the expansive force of the steam, and by the decreasing ratio of the impelling force and the tendency to create a vacuum, and the pencil indicates a series of curves. With practice the eye can discern at a glance a

bad or good "diagram," and the fault in the engine's performance is manifest at once. The diagram shows whether there is too much "lead" on the valves, whether the "cut-off" of steam is too soon or too late in the stroke, whether the pressure of steam on entering is too high or too low, and whether the full economical effect of the steam is employed. It also shows if there is any force left in the steam at end of stroke to be overcome on the return journey, which would be a waste of power, by showing the degree of vacuum that is actually produced after the expansion has ceased; if there be too much of vacuum, the piston will be checked too early and waste of power results. All waste of power means, of course, waste of fuel, which converts the water into steam, the source of power, and any means used to prevent waste of power will, as a logical sequence, reduce the necessary amount of fuel. To call in an engineer to indicate the engine is certainly an expense; but, if he can thereby effect a saving of fuel, it will be a most judicious outlay.

The following short account of indicator and the diagrams given will clearly illustrate this valuable instrument, and show still more the economy of from time to time resorting to its use. The purchase of an engine indicator with proper connexions will, in the end, be found to pay, as with very little experience it can be used by any one, and will save the expense of calling in an engineer, except when the diagrams show that there is a defect to be remedied.

There are several steam-engine indicators in use, but Richards's, with Darke's improvements, is the best we have seen. McNaught's principle is still employed, but with such radical improvements that the original has gone out of date. The action of the Richards's Indicator briefly is this:—A cylinder, with a piston and rod fitted to it, and having a stop-cock and connexion, so that it can be easily fixed to the steam-engine cylinder and be actuated by all the varying pressures occurring during the stroke, conveys its motion through a cross-head and lever to a pencil, which thus describes every fluctuation of the steam. In order to maintain a true proportion between the various points in the stroke at which fluctuations occur, the table on which




A

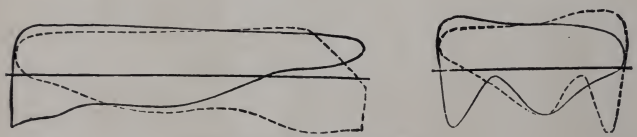
Fly-nut.

Cord Adjuster.

Detent (see A above for its position).

C

the paper for obtaining the pencil diagram is mounted is made cylindrical, and turns upon its axis by means of a cord attached to the cross-head of the engine. As the cross-head moves in the slide bars, so the cylindrical diagram table or drum is turned round under the pencil-point as it rises and falls perpendicularly, in response to the fluctuations of pressure of steam in the cylinder, and as it thus turns a line is described upon the metallic paper that is carried by the cylindrical table, or paper drum. As the cross-head returns again after the end of the stroke has been reached, the cylindrical table or drum, by means of a spring, revolves in the opposite direction, thus completing the diagram. It must be understood that the cylinder upon which the diagram is taken has only a movement proportionate to that of the engine piston; this is accomplished either by a reducing pulley or by a rocking lever worked by the cross-head. In the indicator cylinder, above the piston, is a spiral spring calculated for a certain pres-

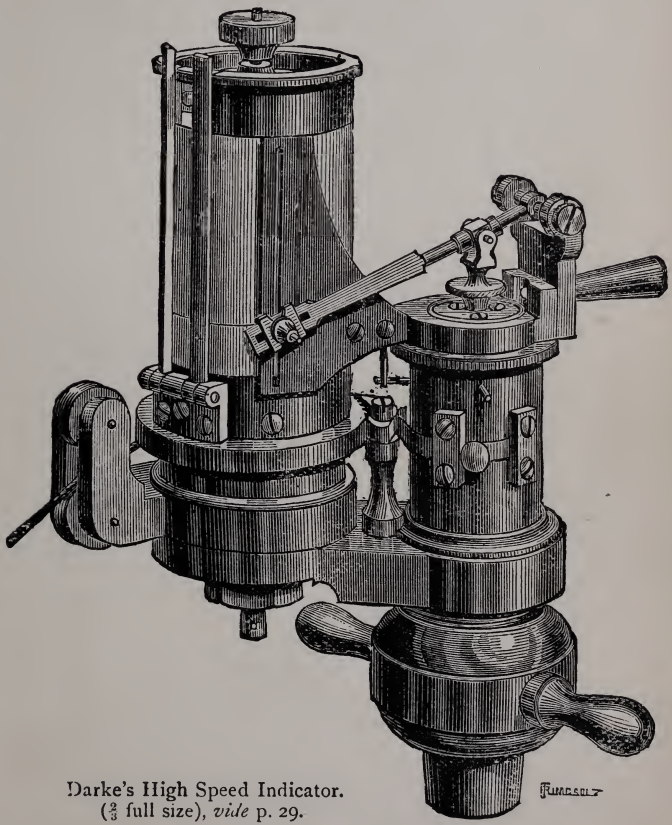


Indicator Diagrams (reduced).

sure of steam, and at that pressure the slightest excess or decrease affects the piston, and raises it higher and quicker, or less and slower, thus showing exactly what is taking place inside the engine cylinder during the stroke and return. For other pressures the spring must, of course, be changed. The diagram thus taken will show, first, the stroke, and then the return, *i.e.*, the steam's action at each point on the near side of the piston, and then the return stroke with the action of the steam behind the piston.

Darke's principal improvements consist, firstly, in a detent, which is an arrangement for instantaneously stopping and starting the cylindrical paper drum, so as to avoid the delay and inconvenience of having to disconnect the cord from the engine cross-head every time it becomes

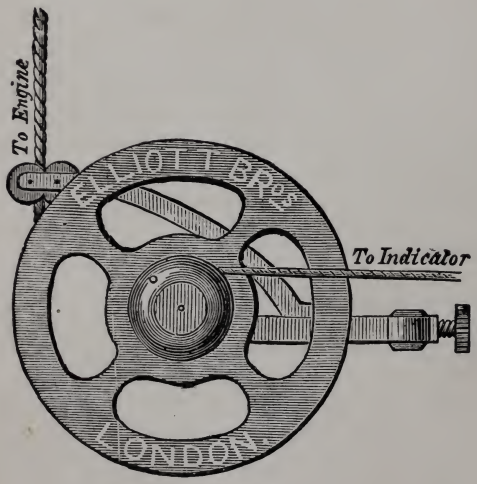
necessary to change the paper, which is either held by clips round the drum, or is in some cases coiled round inside the drum in an endless roll, each diagram being torn off



Darke's High Speed Indicator.
($\frac{2}{3}$ full size), *vide* p. 29.

as required. This is very simply effected by means of a pawl, which is made to rise and fall by a spring, so as to engage or liberate the paper drum by a small

segment of a ratchet placed at its base. By this means a rapid succession of diagrams can be readily taken without delay, or stopping the engine, or disconnecting the cord which turns the paper drum. Secondly, in Darke's cord-adjuster, which obviates the necessity of shortening the cord when required, by making knots which, owing to the presence of grease, are next to impossible to untie. Thirdly, in the use of a fly-nut below the paper drum for securing the pulley-holder in position. It will be seen that as the little cylinder of the indicator is, for the sake of convenience, made small, being actually only one-fourth of the throw of the pencil, and the piston has only an area of about half a square inch, the stroke of the engine piston




Reducing Gear.

must, to maintain a true proportion, be *reduced* also. This is effected by means of reducing gear, which consists of a larger and smaller pulley on the same pivot, the cord from the engine acting on the larger, whilst the cord from the indicator is acted upon by the smaller one.

With this indicator a firm can readily, with a little practice, obtain correct information as to whether their engine, be it steam or gas-engine, is working to the best advantage, the diagrams taken from time to time affording unerring proofs of its efficiency or otherwise. For fuller information, we would refer those interested to a valuable work on the Steam-engine Indicator, by Mr. Charles T. Porter, which can be obtained from Messrs. Elliott Bros., 102, St. Martin's-lane, who are the sole makers of the Richards's and Darke's Indicators.

The reduced indicator diagrams on page 26 were both taken from sister engines of torpedo boats, low-pressure cylinders; the left-hand one at 400 revolutions per minute under 80 lb. steam pressure, 40 lb.=1 in.; the right hand at 350 revolutions 80 lb. steam, 37 lb.=1 in.; the former by means of Darke's high-speed indicator, as shown on page 27 (the only one, by the bye, suitable for gas-engines); the latter with the ordinary Richards's. Those "in the know" will admit that the latter is valueless as an indication of the action of the steam; whilst the first is an exceedingly good diagram; from which it is clear that for high speeds it is the only reliable indicator, a fact of importance in obtaining correct diagrams from gas-engines, where the sudden explosion gives rise to very rapid motion at the initiative stroke.

In connexion with motive power, we may point out that the shafting pulleys and straps act *against* the engine as retarding forces, the friction in the bearings, the strain of the straps drawing the shafts against one side or other of the "brasses" or "journals." To lighten the load as much as possible, and thus increase the amount of transmitted power, steel shafting and wrought-iron drums and pulleys may be substituted with very good results for wrought shafts and cast-iron drums, &c. Steel is, strength for strength, considerably lighter than wrought iron, and resists torsion better. A curious fact is, that a strap or belt running on a wrought drum has at the least one-third more "bite," or, in other words, a three-inch strap with a wrought drum is equal to a four-inch belt on cast iron. The cast-iron drum will weigh at least twice as much as the smaller and slighter-made wrought-iron one. Nor is this all; the

straps, as they do not slip, will wear much longer, and will not part so often through the laces being cut; and, as one-fourth of the width is saved, the expense of strapping and mending is reduced altogether nearly one-half. In speaking of belts, it is not generally known that the outside of the leather should run next the pulley—not the fleshy side—the "bite" is better; the strap can be run tighter, and will wear longer. A moment's thought will show that if the outside, which does not stretch, is run outside, the soft side is compressed whilst passing over the drum, and stretched again when free; whilst, if turned the other way, the soft side, which easily stretches, is never compressed and the hard side is always at the same tension. A trial, however, affords the best proof.

Another consideration is that in case of fire cast drums fly to pieces, whilst steel shafting and wrought drums can be easily repaired and used again. Moreover, as three-fourths only of the width of belt is required to replace them, a saving is effected of fully 25 per cent. Thus, there is a saving all round: firstly, of power; secondly, of friction and weight on journals, and on the building; thirdly, in strapping and repairs, and consequent stoppages.

## CHAPTER V.

Tools—Hand Tools—Sharpening—Cutting Edges—French Wood-engraving Tools—Poster Cutting Tools—New Tool for Outlining—Tinting Machine Tools for Wood, Stone, and Copper-plate—Pencil-holders for Compasses—Litho Brushes.

THERE is, perhaps, no subject so vast as that embraced by the title of this chapter if not limited by some classification. From the spade, said to be the earliest invented tool, to the splendid, self-acting machinery of the modern engineers, a wide range is embraced by the word "Tools." It is, however, beside our province, and would not, perhaps, interest our readers, to go beyond the category of tools used in the printing and paper trades; and even this range must again be confined to even a still narrower circle by circumscribing it to the range of tools properly designated as "hand tools," in contradistinction to machinery. We have already alluded to such manuals as WYMAN'S TECHNICAL SERIES, and have pointed out their value as reference works, to be consulted as to the purchase of machinery; it would, therefore, be a work of supererogation to go over the same ground again. Nor is this necessary to the object of this series of papers, with the sole exception of making some allusion to engraving machines, which, whilst they may be classed as machine tools, may also, and with more reason, be treated of as hand tools, since they cannot, by reason of their inherent action, be actuated by any other motive power than the hand or foot of the operator.

Glancing at the simple tools of the ordinary printing-office,—the saw, the plane, and the gimlet,—we cannot remember to have met with a single exception, in any printing-office, at home or abroad, to the rule that these are invariably unfit to work with. The saw has no "set,"

its teeth are either broken or so dull that they will not cut, and the blade, through misuse, is twisted, so that even a good workman could not saw with it, either straight or square. The plane is invariably dull, the iron cover of the blade is never square with it, both want grinding, and ten to one the face is scratched and warped so much as to render it useless; and as to the gimlet, that, having lost its point and become rusty from want of use or care, is generally mislaid and cannot be found at all. Those printers who think this picture overdrawn have only to inspect the tools in their own office to acknowledge at once the truth of our remarks. Having thus called into question the efficiency of these common tools, we will point out the remedy. It can, perhaps, hardly be expected of compositors or machine-minders, or of the ordinary *employés* of a printing-house, that they shall possess any practical or technical knowledge of tool-sharpening; therefore it is advisable that some one be employed to keep all such tools in order. The expense incurred, whilst really debited to loss, ought to be carried to account as profit, seeing that any attempt to work with tools unfit to use means a waste of at least 75 per cent. of a man's time. No one who is not a thoroughly practical workman can adequately estimate the loss of time that bad or badly-used tools entail.

A little explanation as to what ought to constitute a cutting edge for tools may not, therefore, seem out of place, since such knowledge will save money. Tools, such as chisels, plane-blades, gouges, &c., when sold, are not by any means fit for use: they require *setting* before using. The face, *i.e.*, the front flat surface, is only ground, and the scratches left by the grinding, being so many grooves, leave as many corresponding teeth in the edge when sharpened, and, if looked at through a microscope, show a distinct succession of unsharp intervals. But if this flat face be rubbed upon an oilstone (or hone, as it is sometimes called), until every scratch has been rubbed out, and until the face presents the polished appearance of a mirror, the first desideratum is accomplished. Then, turning the tool, and rubbing it at an angle of about 70° for a very sharp edge, or 60° if for very hard wood, and keeping the hands steadily to the angle with equal lateral pressure, a square,

flat, true edge at an angle of 20° to 30° to the face is produced. It this rubbing is done so as to make the edge round instead of flat, thus (see diagram), room is not left for the shaving to pass, or, in the case of a plane, the blade, being fixed at an angle, does not penetrate properly. It must be *flat*. There is always a burr formed in thus rubbing on a hone; it is best got rid of by alternating face and back a few strokes each until it peels off. A scythe or sickle, or a shoemaker's knife, is sharp when a serrated edge exists, and the rougher the whetstone the better it cuts; but in edge-tools this is to be entirely avoided. Wood requires to be cut, not torn. In saws, the theory is different so far as this goes, that the teeth do tear away part of the wood; but even then, to insure perfection, the teeth should lean alternately to one side and the other at the point, in order to produce a groove wider than the saw's thickness, and the cutting edge of each tooth should be at an angle to the side, not square with it, or the sawdust, instead of being cleared away, will clog up the groove. The saw-blade must be flat and straight, or it will be impossible to saw straight with it, and the handle must be in the same plane with the blade, or it is next to impossible to saw square vertically. These three tools,—the chisel, the saw, and the plane,—require practice in their use; and every boy ought to be instructed technically at every Board School how to sharpen, to keep in order, and to use these rudimentary tools; for his after-life experience would always, no matter what he selected as a trade, be rendered easier by this too-much-neglected knowledge, at once so easy to acquire and yet so seldom attempted. Ninety-nine out of a hundred persons cannot saw or plane square and true; and the chisel, with which almost anything can be done by a "knowing" hand, is of no more use in the hands of the million than a screw-driver. It is said that "a bad workman quarrels with his tools"; a good workman is always on the best of terms with them, and can invariably coax them to do his bidding by a friendly rub and the use of a little oil to smooth matters over. Even carpenters do not always keep their tools in order, nor can they do so

when out of doors on a building. Cabinet-makers, and, above all, pattern-makers, *must* do so. If printers, or, at least, one or two in every printing-office, could and would use the tools properly, a considerable gain would be effected.

Pursuing this matter further, how few engravers make the most of the cutting power of a good tool well sharpened! Amongst wood-engravers, great want of attention prevails in this respect, hence their growing preference for French tools, which are sold ready "made up"; but this so-called finish is not thorough, it is only surface polish; it is not the kind of thing required, but an easy substitute,—a "make-shift," not to be compared with what an engraver himself could produce at the cost of a little time and trouble. It has been a frequent source of wonder, during the writer's experience of thirty-five years, that some English firm of toolmakers has never offered in the market tools ready for use. In these days of keen competition, it would pay any user of tools to give twice or thrice the price for a tool which he could use at once, than spend one or two hours of amateur labour in making it up for himself. It may be urged that the edge would not "keep," but two minutes' work would produce a new one. There is another defect in tools, to which, if English makers wish to hold their own position in the markets of the world, they should pay more attention, and that is, that the present wholesale tempering renders almost every tool unequal. It is right at first, but becomes harder and harder as it wears, requiring letting down from time to time. Nor is this a question of price. Once let it be known that a firm would take back any mistempered tool, and art workmen, more especially those employed in the engraving trades and the kindred branches, would readily pay any price that might be demanded. It is merely a question of offering tools ready "made up," with a knowledge of the actual wants of consumers. Once a tool is right, it is easy to keep it so.

The Americans and certain English firms have excelled in cutting posters on pine for black and colours. This wood is exceedingly well adapted for the purpose if the tools used are sharp and well shaped for the work; but English manufacturers of tools are too apt to look at the probable amount of demand, and cater only for the million

instead of making tools specially for a small section of the community. For this class of poster work, which in London is chiefly left to type-cutters,—London printers, as a rule, preferring sycamore or other hard wood to pine, on which alone artistic freedom is possible,—the tools required are a series of very thin gouges, varying in size by slight gradations from the 32nd of an inch to a quarter of an inch, increasing by sixteenths, very deep, and of an almost semi-oval section, or of a parabolic curved section; thus two or three different sizes of V-tools (or carvers' parting tools), two or three bent or "dog-leg" V-tools, some 1¼ in., 1 in., and ¾ in. half-round carvers' gouges for "clearing," and a few flat gouges from ¼ in. to ¾ in.

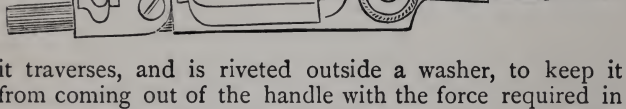
Outlining is generally done by a "knife tool," but we recommend a tool of a better construction (which we illustrate) for this, being applicable for cutting all the facsimile portions of a drawing. It consists of a handle with a slot at its extremity, into which a lancet-shaped blade can be inserted, and there fixed by means of a set-screw. A cur-

sory glance at the illustration will show that great command is at once obtained over the tool by the long leverage conferred by the handle, whilst the hand, which in the old knife tool is always getting in the way of the eye, does not in this tool interfere with the sight, but leaves a clear field of vision. As a blade wears down or breaks, a new one can be inserted in the slot in a few seconds. For cutting curves or cutting exact facsimile work for posters, experience has shown that quite one-half the time is saved by its use; the work is cleaner, there is not half the liability to snip pieces out, and there is a freedom and a look of workmanlike command readily observable in the proof of the finished block, which is wanting in "knife-tool" work.

The writer invented this tool when an apprentice, over thirty years ago, and in his experience has proved its immense value. Ordinary lancets can be used if re-tempered, the same holder and handle lasting a lifetime. As

it cuts both ways, it can be either pushed like a graver or drawn like a knife, which, of course, saves the time of turning a block round, in order to cut back up to a given line. This tool is of immense service in letter-cutting in any soft wood, but its thinness precludes its use on sycamore unless the work be exceedingly fine, where there is no necessity for cutting deep, as it is almost sure to break in hard wood if forced deeply into it. For cross-hatching "on system" it is simply invaluable, and full command of it can easily be attained in from one to two months' practice.

The bar of steel, as shown in the illustration, is $\frac{1}{16}$ of an inch thick by $\frac{3}{16}$ in. deep, thicknessed out at its extremity to $\frac{3}{16}$ in. The slot through it is about the 64th part of an inch wide and half an inch long, allowing the lancet blade to incline either way from a right angle to one of about 60°, as shown by the dotted outlines in the diagram. The bar of steel is forged taper where it goes into the handle, which



it traverses, and is riveted outside a washer, to keep it from coming out of the handle with the force required in constantly drawing it through the wood. It is also better to cut a shoulder on the bar to butt against the handle at its entrance to the wood, in order to secure firmness in the riveting. A set-screw, as shown, is fitted so as to maintain any of the varying thicknesses of lancet in place, except that its point, forming a fulcrum, allows the blade to turn as on a swivel, according as it is to be pushed forward or drawn through the wood backward, *i.e.*, towards the operator. Up to now this tool has been jealously guarded as a secret, or it would, doubtless, long ago have been largely appreciated, and come into general use. The writer has used it for other purposes, notably for cutting cut-through mounts for drawings and photographs.

We may here mention a means of obviating trouble in putting in circles on wood or paper in pencil, especially where they are numerous and of equal size. This diagram shows that the pencil end may be, as it wears shorter, kept

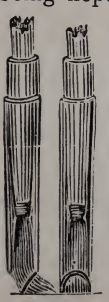
equally at one radius, without the trouble of moving the legs of the compasses. Procure a propelling pencil-case, which may be bought for a few pence, and break away the outer case. The propeller part, which projects the lead by simply turning it round, will be found to fit the pencil-joint of the compasses, as shown. When the lead wears shorter, simply turn the propeller point, and more lead will be projected, thus keeping the length of the two legs equal.

Another plan, useful rather for bow-pencils and spring-bows, is a split tube, in which propelling lead is used. These tubes, as shown below, can be purchased of the

instrument-makers to fit Faber's movable leads, which are made in various degrees of hardness, No. 5 being equal to 3H drawing-pencil. This is very easily pushed through the tube, without slackening the screw, when it wears; the tube being split permits, however, of the screw tightening sufficiently to hold it firm.

Some artists and architectural draughtsmen roll gummed strips of paper round Faber's movable leads till thick enough to fit the pencil-holder, pushing it out a little as the lead wears, but the other plan is more time-saving.

A very useful tool for ruling wide borders on stone or on transfer paper consists of a quill cut taper, as shown in the diagram, in which a brush is inserted, the hairs of which being kept by the quill from spreading beyond the width between the two points, enables the artist to rule a long line at one stroke, the brush holding more ink in the quill than if it were free. The quill also, being hard and polished, readily slides along the edge of the ruler. The V-form in which the quill is cut allows the brush to follow on as shown, and makes the line quite solid. We have used these for outline diagrams for lectures, when lines $\frac{1}{2}$ in. and $\frac{3}{4}$ in. wide were required, using thin brass tubes instead of quills; a set of various widths costs but little, and they are handy tools. Of course, the V-side is used next the straight edge, not the aperture.



A fine brush is used by the Sèvres porcelain painters which we have found exceedingly good as a litho brush, and, as it is not difficult to make, we give its description here. Obtain from any butcher or tripe-dealer two or three cows' ears from freshly-killed animals. Inside the ears are the most delicately-pointed hairs, about an inch and a half long, finer than sable and more springy, a very fine, almost imperceptible point being springy to its extremest end. If a number of these fine hairs are laid together upon a fine wire or a thread of silk, the points being kept further and further back, as they are destined to form outer portions of the brush, and one single hair being kept central for the extreme point, a perfect brush can be put together by winding the silk or fine wire tightly round and round until the hairs are firmly secured in position. Then, to hold it, take a goose-quill, or, if finer, a smaller quill, soak it in boiling water, and, when soft and elastic, push the brush down it point first with a round tapered stick, until it is sufficiently protruding from the quill to form a brush. On cooling, the quill contracts, and the silk winding being thicker than the rest of the brush forms an excrescence that effectually prevents the hairs coming out. It may appear extremely difficult to arrange these little hairs, but it is not nearly so difficult as it seems; with a pair of fine tweezers and a strong glass, it is no more difficult than making a fine steel litho pen, and the attention and care will be amply repaid by the durability and perfection of the litho-tool.

We have seen hard-sized paper, cut in a taper strip, used instead of a quill, being gummed on one side, and rolled like a cigarette between the thumb and finger to form the tube. In Vienna, and, we believe, in other centres of industry, fine partridge feathers in their natural state, and those of canaries and other birds, are used as litho-brushes, the centre quill supplying the spring, whilst the microscopically minute hairs of the feather supply the necessary capillary attraction to hold the ink.

Among the tools, transitional between hand tools and machine tools alluded to above, may be classed ruling-machines for copperplate, for stone engraving, and for tint-cutting upon wood, the principles of which are nearly

identical. The tool is traversed by hand, the distance between the parallel cuts is regulated by a wheel actuating a screw, which moves the tool guiding-bar one, two, three, or more degrees further on between each cut, thus keeping a regular distance between all the lines produced. In wood-engraving machines, the width between the lines is regulated also either by the size of the tool or the depth to which it is permitted to go. Extreme regularity is thus obtained; and, as it is quite possible to repeat as often as required any curve or succession of curves, wavy tints, undulating lines of almost any variety, producing half or quarter tone combined with texture, can be effected. Cylindrical shading can also be achieved with a perfection of result in mechanical work superior to any hand work. The ends of the lines, however, it should be stated, require "returning" on wood, as the machine cannot easily be made to cut dead up to any line, or to commence exactly at any given line.

The best machines are made in America, where they are now almost universally employed by engravers. Machines for engraving on stone are fitted with a tool pointed with a cut diamond, which alone gives a clean line on the stone; and it is by the addition of known weights on a little scale or platform, placed on the head of the tool-holder, that the tool itself is sent deeper into the stone, the rest of the machine being much the same as that described above. These machines are chiefly of German or French construction, stone engraving being comparatively little practised in this country, except perhaps in Scotland.

In ruling-machines for copperplate, as they are technically termed, the varnish with which the plate is coated to resist the acid merely requires to be removed by the tool; the metal itself does not need to be cut to various depths, because the thickness of the lines is regulated by "biting-in" afterwards. In other respects, the principle of their construction is nearly the same as that of the others described above.

There are also machines for cutting wooden type, and "clearing" the larger white or sunk portions of woodcuts in which the tool *revolves*, but a description of these scarcely comes within the scope of our present paper.

## CHAPTER VI.

Lithography *versus* Letterpress—Technical Instruction—South Kensington—National Printing Office.

IT often happens that a very trying question arises as to whether a job can best be done by letterpress or lithography. American writers have recently advocated adaptable machines, so that either letterpress or litho can be printed from the same machine. We cannot see any saving in such a plan in the long run, because the *modus operandi* of lithography is so very different from typography, and depends upon such very different principles, that it would be next to impossible to find a machine-minder capable of doing both, unless he were specially taught, when his wages would be necessarily so much higher that no saving could be safely expected. Again, it seems to us somewhat like taking a steam-hammer to crack a nut to employ a larger and costlier and slower machine to perform the same work as would be better and more quickly done in less space and in a machine of half the value, and requiring only about one-third of the power, whilst on this side of the calculation must be also considered taking-off and laying-on apparatus, which, so far, have never been really successfully applied to litho machines.

The questions arise spontaneously in the mind of any practical man who is not a dilettanti journalist, What can a letterpress machine-minder know as to the requisite regulation of the water for damping? What, in his experience, would guide him in guarding against a stone clogging up? What former practice would enable him to regulate the supply of ink from the duct? On the other hand, what are the chances in favour of a litho machine-minder making a forme ready in anything like economical

time? What previous knowledge would dictate to him the pressure required, the fitness of the compo rollers, the adequate supply of ink, the proper means to avoid creasing of the paper, and all the various niceties of letterpress work? In colour-work, more particularly, the systems are still more in divergence, the black, or key, being invariably the last working, whilst in lithography a blue, printed over the black, and often a red, also finished by one or more greys, are frequently used, as so much less colour is wanted that its transparency heightens the tone and brilliancy of the black ink on which it may be super-imposed. We do not think that it is by any means impossible to construct, cost being unconsidered, a machine capable of doing either letterpress or litho at will, but we think also that it must be conceded that, cost for cost, separate machines, carefully constructed each to perform a special operation economically, will be more likely in the long run to fulfil the desideratum than one machine aiming at an attempt to do both and either. Again, how seldom do we print litho both sides of the paper, and how rarely is letterpress confined to one side only? whilst the different thicknesses of sheets respectively used demand different adjustments of the grippers. Practically, therefore, "let the cobbler stick to his last," and let us pass to consider whether a job can be better done by the one or the other.

The primary light in which to look at the matter is the first cost of reproducing the original. This can be ascertained by asking for estimates of cost from heads of departments, or, if the work is to be put out, from the trade-masters who usually undertake the firm's work. After obtaining these particulars, the next point for consideration is the number of copies required, which involves the question of utilising the various means of producing duplicates of the original, where the size does not practically limit the printing to one original only. If twenty, forty, or sixty can be set up on a sheet, then determine whether transfers or electrotypes are cheapest, keeping in view the probability of a repeat order in the future, in which case, of course, the electros would be ready for use, whilst a new set of transfers would require to be pulled and put down. In very large work, such as posters, where

the detail is not too intricate, blocks and lithography are as nearly as possible the same expense in first cost of reproducing an original, whether the sheets are done in line on zinc plates or chalk upon stone. The copies are turned out quicker by letterpress, but more ink is consumed, although at a less price per pound. Where broad effects rather than detail, or where solid backgrounds are specified, there can be no question that letterpress is by far the cheaper and by far the most effective on the walls; and if the line is artistically done in the cutting the copies can be seen from more than twice the distance that any litho poster could. Again, a consideration in long numbers is the weight of paper per ream which is to be used. Letterpress can readily be adapted to print on paper of little more than half the weight of that required for lithography, which in wall-posters is an item of no mean proportion. No exact rule can be laid down; we can only point out the method of ascertaining which, in the ordinary course of things, is cheapest and best. Other considerations, doubtless, enter, in individual cases, into the calculation; for instance, if there is a pressure of work in one department or the other and a slackness in the other, in which case, even if other circumstances told against such a course, it would manifestly be better to sacrifice a point or two, in order that no machine should be standing idle in either department. Again, if the litho-artists—at, be it borne in mind, comparatively high salaries—be waiting for work, and the wood engravers are sufficiently busy, or *vice-versâ*, this fact should enter into the decision. Sometimes, also, one has to be guided by the time allowed for completion of the order, and it is often better to employ the means which, whilst a little more costly, rivets a customer by promptitude in delivering to time. All other things being equal, where large numbers are on order, it can scarcely be contested that there is a considerable gain both in price and appearance in employing letterpress and blocks, except in chromo work proper, which excels all attempts hitherto made either in zinco process or engraving. With average care, the "life" of a block is 100,000, of an electrotype 250,000, and a zinco-block 300,000 copies, whereas a stone deteriorates very much after 4,000 or 5,000 runs, fre-

quently long before. In some cases, to avoid a double working, to produce, at one printing, part of a job consisting of type or block already engraved, together with the litho portion, transfers are taken and put to stone, whilst in others zinco-blocks are raised from the litho portions and the job is printed by letterpress.

In the first case, especially when a woodcut has to be transferred, the forme requires very great care and very complete making-ready. The litho-transfer ink should be used as strong as possible, not let down with oil or varnish, except enough to enable it to be used with the composroller. A green roller will not stand this; an old one, the harder the better, consistent with its suction and "bite," should be selected, especially in warm weather. If the ink is used stiff and with very little on the forme, nice bright transfers, which will go down to stone crisp and sharp, will be the result. If the pressman uses a shalloon board, or very hard paper next the back of his tympan and a few sheets of paper instead of a blanket, he will not emboss his transfers. If transfers are embossed much they will spread in going under the scraper after damping, and every line or letter will thus be thickened on the stone, hair lines especially will become very coarse, therefore it behoves the pressman to avoid embossing. Too much ink will spread under the scraper, oozing out beyond the sides of the lines, and give an ugly blotty look to the work. If the ink is used too thin, this oozing will be increased, and the transfer will most likely be rotten in places, as diluted transfer ink will not so surely penetrate the stone sufficiently to resist a proper etching, and in working afterwards the work will "gather," because the white parts have not been sufficiently bitten to allow of the gum permeating them thoroughly. In Paris transfers are most frequently pulled on India paper in preference to transfer paper, and the results are certainly better. If a very nice bright transfer be required from a fine woodcut, it is preferable to get an engraver to take a proof with the burnisher on India paper, using the transfer ink full strength with a silk dabber, as he, knowing exactly what effect he wishes to produce, can dab the ink on the dark parts and leave less on fine light tints, and regulate the shades with the burnisher, forcing the brights

and lightly touching ends of lines. This plan also saves the time of the pressman in making ready, frequently, if properly done, absorbing a day's good work. Besides, an engraver *must* know more of the artistic rendering of a proof than any pressman can do without an engraver's education. Immense good would result if some course of technical instruction under a competent wood-engraver could be initiated for pressmen in making ready. It is most important that they should, as a body, know more than they do now of the artistic theory, which is almost an instinct with the engraver, part of whose education is to render an artist's work under the artist's own instruction and supervision. How often, alas! do we find much of an engraver's most thoughtful work not apparent in the printed copies? This is very disheartening to the engraver, is discreditable to the printing-house, and unsatisfactory to the pressman, who has done his best according to his lights. No one will for a moment doubt that there are pressmen who can and do render justice to any block in their making-ready; but, on the other hand, no one can deny that they are the exceptions, not the rule; that they are the small minority—not to be met with every day. It follows, therefore, that men who can so well perform this important work can command a higher rate of remuneration. It would, therefore, benefit everybody all round, employers and employed alike, if this part of their business were more widely understood, because, instead of the few having excessive wages, the many would reap a slight increase on present wages, and work would be better done. It is not that they do not understand how to do the work, when to underlay, when to overlay, or other mechanical technicalities—it is that they lack intuitive artistic perception and even rudimental artistic knowledge. We hope soon to see marked improvement in this respect, trusting that by calling attention to the want, we shall induce those interested to take action in providing for it. The remedy is artistic study on the pressman's part, directed by an appreciative mind and competent experienced guidance. A great stumbling-block is, that a pressman too often fancies that he is bemeaning himself to ask for or accept hints on this subject, and thinks he ought to resent as interference or impertinence

kindly meant counsel offered by those who really do know. This is a great mistake, and one of extreme difficulty to set right, being perfectly natural—attempts to confute it often appearing to the pressman's mind as adding insult to injury. Few men like to admit that they are in the wrong, especially when they pose as workmen competent to do their work, and a confession might lose them their employer's good opinion, if not their situation, and, therefore, very great delicacy and tact should be brought to bear in advocating any plan for their advancement in this direction.

Whilst on this subject, it is difficult to refrain from allusion to another weak point, attributable to the pressmen, as a body, of to-day. No one who has come in contact with the workmen of other countries can be blind to the fact that, in matching any particular shade of colour, our own countrymen are put in the background by their foreign *confrères*, and do not seem to know the fact. A very rudimentary course of lectures on colours—on producing the varied tints required in the everyday routine of artistic printing necessary to satisfy an ever-increasing fastidiousness of a more educated public taste—would rapidly change this regrettable state of things.

Unlike Continental nations, we English have never established a national printing-house, where the elevating encouragement of one of the arts, which printing undoubtedly is, could be carried on without constant reference to the test of £. s. d. as to whether it would pay or not pay. We have our Royal Academies of Painting and of Music, our South Kensington, but we have no State-fed technical school for the printing trades, no Government printing-office, like our Continental neighbours, where new experiments could be tried with a view to perfecting our national proficiency. This has been left to individual effort; the only encouragement has been the hope of distancing competitors, and the firms who have led the van in endeavouring to attain perfection have ended only too frequently in commercial collapse and insolvency. South Kensington itself may be likened to a strong baby thrusting out its hands to grasp the glittering objects just beyond its reach, yet not having sufficient nerve-power to direct its

movements. It has hitherto just missed its mission. There is no doubt it teaches the alphabet, but it does *not* teach to read, and, worse still, it leaves its pupils under the impression that they know enough. The result is that all the artistic professions are overrun with untechnically-educated young people, who attempt, without the advantage of having undergone the drudgery, so useful and necessary, of a term of apprenticeship, to obtain a living —to the disastrous fall of wages and to the detrimental mediocrity of the work turned out. Particularly is this observable in the printing trades. The litho-artists, the engravers, the draughtsmen, and other kindred professions, have been seriously injured by the output of South Kensington students, who flock in shoals into them. Their drawing is correct, it is true; their colouring is very often in the best taste, but they are technically ignorant of the business. They offer to come to work for half the legitimate wages in order to pick up the technical part, and thus injure those who have paid premiums and served apprenticeships. This is no advantage to employers, for the same apparent gain is open as much to one as to all; the work of all these untechnical people is nothing less than a constant series of experiments whilst they are picking up their information at others' expense, instead of the certainty of the foregone conclusions of experienced, technically-educated men working upon what is to them the beaten track leading surely to the expected result.

## CHAPTER VII.

Designing for Printing—Desirability of more Technical Knowledge—Different Treatment of Subject for Different Modes of Reproduction—Commercial Advertisements—Purpose for which the Work is required—Posters—"Composite" Jobs, *i.e.*, partly Letterpress and partly Litho—Spacing of Type—Re-touching Type Transfers—Novelty of Design.

THE art of designing for printing involves in the artist varied capacities, requiring not only an original imagination and refined taste for colour, but also a feeling for the fitness of things. The purpose for which the design is required must be ever kept in view, and in the carrying out of the idea incongruities of style, of colouring, or of form, should be studiously avoided. Then, no mere artistic drawing, however excellent in itself, is sufficient, unless it is also technically practical, which involves an accurate knowledge as to how the reproduction shall afterwards be carried out for printing. We know that too often this point is lost sight of, and designs are offered which could never be carried out with any reasonable number of printings, whereas, if designed by a specialist thoroughly acquainted with the technicalities of the after processes, as good an effect could be produced at a tenth of the cost. Without this technical knowledge,—working in blind ignorance of the amount of useless extra work he is creating and the costliness of carrying out his drawing,—the artist is merely guided by his own taste; and, if the work is limited to price,—often too low to admit of fidelity in rendering the original,—no one complains more bitterly of the result than the, perhaps, innocent though prime cause of its turning out unsatisfactorily.

The fact cannot be too strongly insisted upon, that the exigencies of one process, such as wood-engraving, for example, are not those of, say, copperplate or lithography;

and the same drawing has, perforce, to be differently treated in each case—the style, tone, and depth are so different. As an example, solid black is the easiest to obtain on wood, as the surface, if absolutely let alone, prints black; on copper, black can only be produced by crossing and re-crossing the lines until they run into one another. Therefore, a drawing intended to be engraved on the latter should not depend upon masses of black for its effect, but upon masses of silvery grey enhanced by "whites" and sharp "brights" added after with the graver. It follows, then, that the artist ought to know enough of how the effect is to be brought about to enable him to take the greatest possible advantage of the strong points of the particular mode of reproduction for printing chosen in each case. We have seen how needful this is in the case of black and white only; with how much more force do our remarks apply to colour-work, where even the order in which the colour stones or blocks are superimposed greatly alters the tone of the whole picture? The designer of the job ought, therefore, to know beforehand how each of the endless variety of shades and niceties of his colouring can be "got," as it is called. If he is, from experience, able to give to the chromo-artist, who is to reproduce his sketch, hints as to how he intended to utilise the technical excellences of the materials at his disposal, then not only will it be more faithfully rendered, but also in the most economical way, by saving useless printings and extra work.

Commercial advertisements have, during the last few years, come to demand the highest skill and excellence of workmanship, vieing with good bookwork and even with reproductions of paintings for decorative purposes. By this means public taste is being rapidly educated to criticise and to condemn all but the best and most attractive efforts in this direction, whilst the keen competition between rival manufacturers of similar articles still further stimulates them to order more and more costly and more highly-finished show-cards and labels. It is, therefore, evident that a very wide and varied field is opened for the artist-designer who chooses to qualify himself by attaining a practical technical knowledge of what to introduce and

what *to* omit in his share of the work, which, if he likes to make it so, is the most important of all. The very order we have seen frequently depends on the sketch being so good as to please the eye, and so novel as to imbue the customer with a conviction that it will be worth doing as an advertisement, and at a price that he can afford to pay. If the artist is not thus technically able to produce a sketch capable of being carried out with a reasonable number of printings, what will be the feeling of the customer when the proof is submitted and the inferiority to the copy is made manifest? It would be useless to plead that it was (as the French say) an "impossible" sketch. How was the customer to know that? His contention would be, that he ordered, and is willing to pay for, a number of copies of a reproduction of a sketch submitted to and approved of by him, which the one in question would not be. This evidently is the fault of the sketch not being what it ought to be. It is to the interest, therefore, of employers only to place their orders in the hands of those who have taken the pains to make themselves familiar with the necessary technicalities.

The artist-designer should also bear in mind the intention or purpose of the work, and treat the subject in strict accordance with that purpose. Suppose a show-card be required; it is evident that a very different treatment will be necessary than if it were for a poster on the walls or for a framed railway-station advertisement. The style wanted for posters is totally different from show-card work, for the simple reason that, in the former case, the distance from the eye of the beholder is many times greater, whilst the latter is criticised at "close quarters." The designer should remember that "distance lends enchantment to the view," softening hardness and roughness; that delicacy of half-tone and finish are absolutely thrown away in a poster, where the sole object ought to be that it should have great force, so as to stand out from the wall. As well might a miniature painter paint scenery for the stage in his usual carefully-stippled style of work, as a designer finish a sketch for a poster as if it were for a show-card. In the same way, the artist-designer need not use grey, except sparingly, for he can count more surely upon distance greying down

his brightest colours. The attributes of a poster should be free use of black, and of pure white, and the three primary colours, red, blue, and yellow, which we have heard rather contemptuously termed "fire-engine" colours. What if they are? The object of a poster is *not* to escape notice, but to challenge attention; and therefore "fire-engine" colours (the more *éclatant* they are the better) are the most suitable. Nor does it follow that the poster which looks first-rate when close to the eye will look well at its properly-intended distance. On the contrary, it will not look so well as if it appeared rough when closely inspected. Customers generally seem to think that a close inspection is the proper criterion for judging, entirely ignoring the true purpose of the work. What, we would ask them, would be the architectural effect of placing highly-finished, carved ornaments at the top of a high building, such as would be perfectly reasonable on a gilded picture-frame?

Let us now consider such jobs as are partly letterpress and partly litho. The designing of these may be simplified by first selecting types not incongruous with the general idea of the composite design, having them "set," and then completing the design on a proof of the type matter. This not only saves time, but gives the idea in a more complete form when submitted to the customer, whilst it helps the designer to see at once what is wanted to fill it out and balance it. It also saves the time of the compositor, who has his *measure*, as it were, left to his taste instead of being obliged to select type that will come in to fit certain predetermined spaces. It also enables the artist-designer to correct the often very ugly spacing of type, as, for instance, the letter "I" between two "N's," where they are almost touching, and, in the same line, an "L" next an "A," which leaves a wide gap. Compositors themselves, in displayed work, should study, by means of putting in spaces between the close letters, to obviate and regulate these unpleasant-looking defects, which are inherent in all movable types, but which are more noticeable in fancy "sans-serifs." We think that, particularly in the larger sizes of such fancy "sorts," the straight letters B, D, E, F, K, L, P, R, should have a "beard" left on the straight side, and H, I, M, N, and U on both sides, to

compensate for the space left on such letters as A, V, W, &c., and the round letters as C, G, O, Q, &c. Type-founders would confer a benefit by carrying out this suggestion; the fact of the "body" being heavier would compensate them for all extra trouble such a change might entail upon them, and the result would greatly enhance the appearance of their "founts" when "set." To printers the gain would be the time now spent in correcting the unsightly effect of what in litho work would be termed "bad spacing." When the transfer from the type is ready to go to stone, either alone or together with litho work, the "writer" should touch it up here and there with a pen or brush. A little hair-line ornament, introduced according to his taste, will effectually take off the inherent stiffness of type, and give a touch of freedom to its appearance, especially to initial letters. Whenever there is a very full allowance of small lettering, there is a palpable saving of time in using type transfers along with litho work. And, if judiciously chosen type be used, and it is afterwards touched up, the general *coup-d'œil* is enhanced rather than deteriorated by its use, the extreme regularity of form and size of letters cast in the same mould, impossible to attain in any other way, being far from unpleasing to the eye.

So much variety of design has already been achieved that it daily becomes more and more difficult for the artist-designer to strike out into entirely fresh paths, and it is becoming rarer and rarer to see anything done that is entirely original. Most designs appear, nowadays, to be "prigged" piecemeal, a bit from one thing and a bit from another; an idea copied here and treatment copied there, so as to form a different combination. All the various styles of ornament, ideas suggested by flowers, by architecture or decorative art, have been over and over again impressed into the service, and the want of freshness is the designer's great difficulty, for "scissors and paste" will not answer at all times. Originality of imagination is a gift, and one that is not by any means freely bestowed on the many; when found, it is, therefore, worth rewarding well. We have, in the absence of modern novelty of design, fallen back on revivals of ancient and forgotten stylse until

that also is played out. We have gone to China, and Japan, and to the barbarian for ideas, and have rung the changes of treatment in nearly all possible ways, and now we have to await some new development. Here is a field for invention worth cultivating by those who have the requisite talents, offering at the same time a fair prospect of adequate remuneration.

## CHAPTER VIII.

Enlarging—Reticulation—Centre lines—Magic-lantern Enlargements for Posters—Reducing by Photography—The India-rubber Pentagraph—Proportionate Sketching—Reticulation Apparatus.

THE most usual method of enlarging a drawing is the following:—Rule the original in squares of equal size in fine pencil; mark out the size the enlargement is required to be, and divide it into the same number of squares; then carefully copy in each square of the enlargement whatever is found in the corresponding square of the copy. This is termed enlarging by reticulation; and, although it is sufficiently accurate for securing the relative position and proportionate size of the objects in the original, it cannot be relied upon entirely for obtaining the "swing" of a figure. For alterations and for ease of rubbing out in case of mistakes, we recommend enlargements to be first drawn in with vine charcoal, and afterwards corrected with crayon-conté, or put in with lamp-black and a brush. It is well to draw a centre line down each of the figures of the original, and where these centre lines cross the reticulations mark a centre line on the enlargement, from which measurements right and left can be marked off to scale, thus obtaining readily the exact "pose" or "swing" of each figure. It requires careful attention to enlarge by this means, and occupies a considerable amount of time; but it is of great assistance, and is, we think, easier and quicker than attempting to enlarge simply by the eye assisted with a measure. It is quite as likely to be correct, and the eye can afterwards be relied upon to correct any defects in the drawing.

If any particular multiple of the sketch to be enlarged is specified,—such as 4, 6, 8, or 10 times the size,—the size of each square of the enlargement will be 4, 6, 8, or 10

times the size of each square of the original. This will give the exact scale, and every measurement from figure centre lines in the original must be multiplied by the same number to give the true proportionate measurement on the enlargement. In most establishments enlargements are not of everyday occurrence, and therefore the above plan will be found sufficient for general requirements.

Whenever there is sufficiently frequent demand for enlargements of sketches for posters, to make it worth while the best plan is to use the magic-lantern. It is used in this way:—A copy of the sketch is taken by photography, reduced to the size of the lantern-slide, *i.e.*, 3 in. by 3 in. The slide is placed in the lantern at the proper distance from a sheet of paper mounted on a perfectly upright board; the image is then thrown on the paper, and the outlines can be readily traced with charcoal. By altering the distance of the lantern from the paper, the size of the image is made larger or smaller until the proper size for the paper is obtained. Then, by screwing the lens in or out, the proper focus is obtained, and every detail is clearly defined. To guard against distortion it is absolutely necessary that the lantern lens should be exactly opposite the centre of the drawing-board. It must not only be opposite the middle point between the ends of the paper, but also exactly level with the middle point between the top and the bottom; or, in other words, must be square with the principal visual central ray. The front of the lantern, and hence the plane of the lens, must be parallel with the drawing-board. In order to secure absolute certainty in this respect, the lantern room should have two rails of wood nailed on the floor at right angles to the drawing-board, upon which the wheels of a stool to carry the lantern may run; or the wheels may run in grooves. The height of the stool should be such that the centre of the lens may be exactly opposite the centre of the paper. Move the lantern how you will, backwards or forwards, it can never be out of square, and cannot distort the image. This arrangement, however, would be useless unless the photograph had been taken with similar care. Many photographers take no precautions to insure the camera being square with the board on which the sketch to be

copied is mounted, and do not appear to think it of any consequence that the centre of the lens should be opposite the exact centre of the copy. But, if it be borne in mind that in the small copy, say 3 in. square, an almost imperceptible distortion of, say, the thirtieth part of an inch, would, when enlarged to 10 ft. square by the lantern lens, —that is, forty times the size,—become a distortion of an inch and a quarter, it will at once be seen how necessary it is to observe the minutest care to prevent distortion, and this can only be attained by placing the lens of the camera opposite the exact centre of the sketch. Two diagonal pencil lines drawn from corner to corner of the sketch will give the quickest way of finding this central point, and the same plan will give the central point of the drawing-board or of the large sheet upon it.

The photograph may be either an "intensified negative" or a "transparent positive," some preferring one and some the other. In the former the whole disc is dark, the black lines of the original appearing white; in the latter the ground is white, with dark lines upon it. As the positive is produced from a negative, both might be tried. Colour, light and shade, and other qualities of the original, such as brush marks, stippling, &c., are all reproduced in the photograph and are also enlarged, tending to confuse the outline proper. It is therefore recommended to make a careful tracing of the sketch, and photograph from this outline tracing, instead of from the sketch itself; the outline only will then be thrown on the screen, and the work of following it out with charcoal will be very much simplified. If a negative be used, and the white lines are to be covered up, one can see when every line has been gone over, even if the room be necessarily nearly dark, because, as the charcoal darkens the only white parts, they no longer show at all. If a positive be used, it is not so easy to see when every line is gone over with the charcoal. Care should be taken that the slide is put in with the right side next the condenser, or it will, of course, be thrown the reverse way on the paper. Being transparent, this mistake might easily be made unless there should be any writing or printing upon it, when the error would be immediately noticed. The negative reverses it, and the lantern brings

it back again; thus the right-hand side of the sketch is on the left in the negative, and, if the slide be put into the slide-holder properly, the image will have the right side. Of course, the slide must be upside down in the lantern, or it will be thrown upside down on the paper, same as the sketch.

If it be required to enlarge the sketch to any exact multiple of its size, the following will be found a most useful plan:—Suppose the enlargement required is to be forty times that of the sketch: a line either 1 in. or 1 ft. should be drawn on the sketch at the bottom or side, and divided into forty parts. When the lantern is at the right distance to throw the image, this line will also be thrown upon the paper. Each of the forty divisions will then be of the same length as the whole line in the small sketch, that is, 1 in. or 1 ft. long, according as an inch or a foot has been divided on the sketch. By testing this with a rule, and bringing the lantern nearer to make it smaller, or removing it further off to make the image larger, the greatest accuracy can be insured.

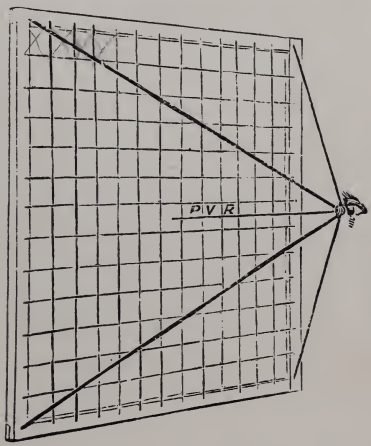
The room should be carefully darkened in the daytime by blocking up the windows during the operation of tracing the outline; but some shutter, easy to open, or other means of letting in the light from time to time, should be arranged. If the job can be left until after dark, a gas-jet turned very low may be used, and turned full on from time to time to see how the work progresses, and to make sure that the charcoal has marked the paper sufficiently in every part.

Nowadays very few reductions are made by hand. Thanks to photography, speed, economy, and accuracy are attained in reducing, be it an engraving, a litho, or a block, with which hand labour cannot compete.

There is another valuable aid in reducing sometimes employed, namely, the india-rubber pentagraph. It consists of a frame which is made to contract or expand, and to the edges of which a sheet of finely-surfaced india-rubber is attached. Upon this india-rubber, when fully stretched out, an impression is taken from stone, or block, or type, and the rubber is then allowed to contract to the required size, when it is re-transferred to another stone.

The pentagraph, however, is now to a great extent superseded by photo-lithography, as originals can also be reduced. If a reduced copy of a chromo be desired, photo-litho the key, and make off-sets for the colour stones, as even with the greatest care register cannot be expected if each colour is to be also reduced by this means. In the case of woodcuts, the original for reduction can be photographed upon the wood and engraved, or a photo-litho taken and transferred to zinc, and afterwards bitten up for printing at letterpress.

Proportionate sketching of very intricate detail for cata-




logue work, when it is not convenient to photograph the object, may be performed either by tracing the outlines on the ground glass of a photographic camera, or by the use of the following simple apparatus: — Take a frame or "stretcher," and divide its length and breadth into inches at each side, say, 30 in. one way by 20 in. the other, which gives a very convenient size. At each inch mark fasten across alternately, say, red, blue, yellow, white, and black twine, and repeat until the opening of the frame is divided into a series of 1 in. squares. Fix four wires to the four corners of the frame, and let them unite together in a ring or collar about one-eighth of an inch in diameter and a

quarter of an inch long; and let this ring be exactly in the centre of the frame, and about 13 in. from the network (see diagram). If this frame be hung by a string from the ceiling between the eye and the object to be sketched, the network, which represents the picture plane, being square with the object (*i.e.*, with the principal visual ray), upon the eye being applied to the short tube the object will appear as if it were divided into reticulation squares. If the paper be now divided into similar squares, and the intersections carefully noted, a very accurate and perfectly proportionate sketch can be obtained. The object in view for using coloured twine is to enable the operator readily to count the threads, to insure his easily finding the corresponding square on his paper. The reason for the four wires uniting in a central point is to maintain a uniform distance and position for the eye, which otherwise could not be kept at one spot, the result being that the perspective would alter with each change of the eye's position. Where there are two rooms with a door of communication between them, this frame can be fixed upright in the opening or doorway when in use, making it firmer than when merely suspended from the ceiling. In this manner chandeliers, clocks, statuary, and a vast number of objects for catalogue illustrations can be rapidily and accurately sketched; and, if the same distances be maintained in all cases, the sketches of the various objects will all be of the same relative proportion.

## CHAPTER IX.

The Theory and Practice of Line in its application to the Printing Trades—Reproducing Effect—Texture—Direction of Line—Perspective of Line—Photography.

WE now propose to give our readers a series of facts which hitherto have been more or less ignored, and to deduce from them simple applications of great practical utility to the artist, the engraver, the lithographer, the pressman and machine-minder, and indirectly to overseers and managers of printing-houses, both letterpress and lithographic. We have never seen any complete treatise dealing with the facts and their inferences connected with this highly-important subject of "line." If we are to keep pace with Continental and American rivalry in excellence of work, a knowledge of the reason why certain things ought to be done is of the utmost importance. It is the first step towards bringing about intelligent rendering of artistic reproductions, and that with the smallest expenditure of time. It is evident that, when the workman thoroughly understands what he is doing and works systematically, he can reproduce the ideal of the designer in considerably less time than he would otherwise require. If, as is now too often the case, he is groping in the dark after an effect which is not fully comprehended in his mind, and by means the use of which he has not mastered, he will be certain to waste both time and energy, and the result must be unsatisfactory.

Firstly, line is able to give the proper weight and force of expression necessary in depicting the exact shade developed by nature in her balance of light and darkness which we commonly term "effect." Every possible gradation may be obtained from black to white, which is our

full compass, and represents "in petto" the whole field between the most sombre darkness of night and the most brilliant tropical sunshine or light. We have, of course, nothing blacker than black to give force; nothing whiter than white with which to express that glorious, almost-blinding brilliancy and purity which we call light. All intermediate shades must be produced either by means of a wash (*i.e.*, a pale shade of colour diluted as to strength with water), or by a series of lines, or dots, or other forms of jet-blackness interspersed with the whiteness of the paper which forms the ground upon which we depict our effects.

Even a wash, however soft and apparently even, under the microscope shows that it consists of minute points of colour varying from grey to black with interstices of white, and it is this which gives it transparency and value to the naked eye. Thus every tone is given; but as the most permanent possible vehicle for printing is carbon ink, which is black, we are enabled, by means of lines or dots (all of which are fully black, with white interstices, and when seen from a distance appear to mingle together) to reproduce the appearance of a wash so far as tone goes. By varying the thickness of the lines and placing them nearer together or further apart, so as to alter the proportion of black to white, any degree of light or dark tint can be produced. Thus it is evident that line is capable of rendering every intermediate shade from black to white.

Secondly, line is capable of expressing the perspective of all surfaces, and of producing on paper the effect of atmosphere, often called *chiaroscuro*, or aërial perspective. If the outlines of a table or other receding surface be drawn, and then horizontal lines be ruled, commencing with the most distant edge, in a very light fine line, gradually making the lines thicker and further apart until the whole surface is covered, it will at once be apparent that the fine lines look much further off than the nearer part where the lines are bolder. Or, take any good woodcut of machinery, and examine the shading of a cylindrical surface, it will at once be evident that it appears round wholly and solely because the lines by means of which it is shaded are finest at the most distant parts, and are graduated till the

boldest lines are where the nearest point of the surface would be in nature. We can see, therefore, that the laws of perspective govern the theory of line quite as much as that of outline, and a knowledge of these laws, as applied to surfaces more or less shaded in line, gives certainty of achieving the result aimed at. If, therefore, carrying out the same principle, the most distant parts of a landscape are given in very fine line, gradually getting bolder as objects are nearer, and finishing with coarser lines in the foreground, the effect of atmosphere will be attained.

Thirdly, line affords the best possible means of representing "texture," *i.e.*, the substance of the surface itself, whether it be wood, iron, marble, stone, velvet, silk, linen, or flesh. Water and sky can be expressed by means of line, and almost anything else. We shall see later on how and why certain varieties of line express the idea of the texture of certain surfaces, and see also the necessity for studying such effects very closely.

It is a theory held by some that, to a highly-trained, imaginative artistic mind, line will almost supply the place of colour, if it be only carried out very carefully and intelligently. While we cannot go practically so far as this, still we have seen skies so beautifully engraved in horizontal and oblique line that we had no hesitation in saying which were the azure-blue parts and which the grey, and could almost fancy we saw a faint tinge of these colours. In heraldry, representations of armorial bearings, uncoloured, are engraved in lines of different direction, and are, by common usage and consent, universally understood as well as if they had been painted in the proper colours.

When once its practical utility is realised, the direction of line is one of the most interesting studies that one can engage in. It opens up many side issues, so to speak, and compels attentive thought and analysis of the principles of perspective carried out much further than the text-books go. To those whose time is fully occupied, such as the apprentice to engraving or lithography, or the printer of artistic work, the collection of facts we place at their disposal will be of great service, and our object will be attained if we can only set our readers thinking the subject out for themselves.

It has been affirmed that, in this latter half of our century, the "historical engraver" has almost ceased to exist. Photographic and photo-engraved copies have cheaply reproduced the work of our eminent painters, instead of the translation from colour to black and white being intrusted to men whose whole life-study has been to learn how to render in line the subtle and beautiful poesy of pictures. It has been said that the art of line-engraving is fast dying out, and that soon it will become impossible for the Academy to find applicants for their future vacancies in engravers' associateships. This will be an eternal disgrace to the art reputation of England if it ever comes to pass. Its causes—and they are many—do not, however, come within the scope of these pages; but, in passing, we may say that true appreciation and thorough comprehension of the truth and beauty, the utility, expressiveness, and power of line by the rising generation would tend to make that day far distant. What is required is to educate the public taste, and our school boards and Science and Art Department ought to take some steps in this direction, or practically the fine art of historical line-engraving will die out for want of support.

To give a correct *rationale* of the principles on which line is founded, and proofs of their correctness, let us suppose an object to have lines drawn upon its surface of equal thickness and at equal distances apart. Suppose the object to be a box, for instance, the lid ruled lengthwise parallel to the edges, and the sides and ends perpendicularly, the lines all over being uniform in thickness. A photograph taken of this box in various positions would indicate clearly these lines, but it would demonstrate the perspective law of vanishing the lines on the lid to the same vanishing point as the outline. On retreating sides or ends the vertical lines and the spaces between them would appear in the photograph to be narrower and narrower the farther off from the eye they were. The lines and spaces also would not only vanish to the same vanishing point, but would appear finer and finer the more distant they were. And, further, each line and each space would seem to become gradually finer and thinner towards the vanishing point, *i.e.*, the lines and spaces would vanish to that

point, thus forming *taper* lines. In other words, the two edges of the line itself would vanish to that point. All who are familiar with perspective outline-drawing know that to heighten the effect of retreating planes the lines forming their boundaries should be drawn taper, getting finer in proportion as they recede towards the distance. It is only carrying the principle further in the scientifically true direction that all shading by lines should follow the same laws as the outline is governed by. A vertical surface, therefore, should be shaded by vertical lines, a horizontal one by horizontal lines; and the idea to be borne in mind throughout should be that the object itself is imagined to be covered with lines equidistant and equal in breadth. This great fundamental principle is capable of endless extension, for every curved surface or plane, no matter at what angle it is presented to the eye, must be treated exactly in the same manner. Undulating surfaces obey the same law, each part of such being in reality part of a curved surface. A rough surface is simply an agglomeration of small surfaces at various angles to one another. Folds in drapery are nothing more nor less than curved or undulating surfaces, and must be expressed in line perspectively correct. If proof be still further required, take a photographic portrait where the sitter has worn a *striped* dress, or a coat of some ribbed material or diagonal cloth. Carefully note the beautiful gradations of thickness, or rather, breadth of the lines, their graceful curves and their disappearance behind a receding fold as they are presented at endlessly-differing angles to the eye, or, what is the same thing, the lens of the camera. A camera is but a model of the human eye,—its achromatic lenses imitate the iris, its ground-glass back the retina, its diaphragms or stops the contracting and dilating pupil. But that most wonderful and almost inscrutable agency whereby the impression is conveyed to the brain by the eye, with all its varied colourings and delicate undulations of form as pictured on the retina, is but faintly followed by the photograph, devoid of colour and falsified and often distorted by the imperfections inherent in all hitherto-attempted lenses. Yet let us acknowledge that the camera has been of immense suggestive importance in its influence on art.

No one who has attentively noted the gradually-increasing correctness observable in drawings and engravings since the discovery of photography can help acknowledging how the influence of this scientific art has educated the eyes of the masses as to the proper proportions of the figure and the correct perspective of objects in general.

The looseness of drawing, even of great painters, deservedly so called, of fifty years ago, and their errors as to perspective, would not be tolerated now; their faults then remained undetected. Science ever leads the van, beckoning Art to follow, and though artists may pooh-pooh the photograph, and refuse to see any artistic beauty in it, yet they must admit that it has already been productive of much improvement. It has taught the world to be more exacting in its demands for accuracy of drawing and closer study of perspective, the alphabet of drawing, and thus supplied a much-needed incentive to the artist to neglect no means of perfecting himself in the knowledge of his work.

And, if photographs are not distinguished by artistic feeling and rendering, whose fault is it? If *pose* and harmonious grouping, accessories, drapery and artistic effect are frequently quite disregarded, whose fault is it? Certainly, not the fault of this art-science. It is within the province of art to help science just as science contributes to help and further art. Photography, under the guidance of an artist, is just as capable of rendering artistic effect as it is of giving inartistic and unpleasing pictures, for which, as a science, it is not in any way responsible. A vivid and accurate rendering of what is presented to the lens is all we expect from it. That this is so seldom pleasing depends upon the way the subject of the picture is arranged and lighted, and the defect of distorting colours unstudied and not mitigated by judgment and thought. The engraver, at any rate, might very profitably study photographic line—its invaluable hints only wait his research to prove profitable. They offer a field of investigation likely to yield secrets that will afford him satisfaction, and help him to render his reproductions scientifically and artistically, and with full power.

It cannot be denied that, under many circumstances, whatever may form the background of a picture, and is,

therefore, not the principal object of interest, should lose detail and become broad in treatment, so as not to divert the eye from what it is sought to invest with most prominence and importance. Hence, to preserve, in the direction of line, the rules above laid down might break it up too much. That is, to preserve throughout vertical and horizontal lines according to the relative positions of the surfaces or planes forming the background, would confuse the picture, by withdrawing the eye from the main point of interest, be it figure or face, causing it to wander and so conveying a sentiment of unrest. To avoid this, in a scientific as well as artistically correct manner, without violating the principles which we have seen must govern line, we must deduce some other idea, modified yet in accordance with these primary laws. Like the camera, the eye takes in only so much of the picture as lies between two rays which enclose an angle of about 55° to 60°. But, as the eyes move round so easily, this is not apparent unless proved by the actual experiment of keeping the eye motionless; by looking through a pinhole, for instance, its truth is at once made evident. The principal visual ray, as it is called, bisects this angle, being itself at right angles to the picture-plane and being also central. Every object, whether distant or near, within this field of vision is of necessity less obtrusive in proportion as it is more removed from the central ray. Now, its perpendicularity or horizontality, like any other quality possessed by such object, becomes less easily remarked in the same ratio; hence, to distinctly express such qualities by line would be to give wrong impressions of the importance the object might possess, and so make it an intrinsic part of the picture. Between the extremes of perpendicular and horizontal come the oblique or diagonal directions of line, and neither extreme is injured if the mean between the two be adopted. Here we have at once a logical and scientific solution of the problem. If we cover down in a diagonal direction all insignificant details or separate objects, especially in the distance, by such lines, breadth of effect will result by the modification of the attributes of such details, which, were they the principal objects of the picture, would have to be carefully, truthfully, and thoroughly expressed.

In order to keep in the mind distinctly the theory of the mean diagonal of line, let it be conceived that a veil be drawn over the whole of the picture behind the principal object. Imagine this veil to consist of a gauzy material almost transparent, the threads of which, though almost impalpable, run diagonally, but which follow all the undulations of the relief, so to speak, of the picture, lying, as it were, like a shadow upon all the varied surfaces. Following out this ideal diagonal veil, let us suppose a curtain or other drapery. In giving each fold in line the flow across the whole in one diagonal direction would give breadth, and the stiffness that vertical, or almost vertical, lines would impart would be lost, and in its place grace and freedom of treatment would be attained. Similarly one could imagine the curtain to be woven "on the cross," that is, diagonally. The projecting folds, receding parts, and the deeper hollows would modify the straightness of line and cause them gracefully to undulate, and the meaning of each wave of line would be at once felt and comprehended. The preponderance of slanting direction of line would prevent the background from detracting from the value of the more emphasised attributes of the principal object in the picture, where the line is more varied in direction, to express to the eye the exact degrees of inclination, perpendicular or horizontal, of its various surfaces. Horizontal lines, being restful and expressing repose (from the fact of our lying down horizontally to sleep), may also be used in distant landscape or other backgrounds, and ought never to be departed from in sky or water, nor in broad plains or wide expanses of flat country. By various modifications a universal horizontal line throughout will express all that it may be wished to give of the less significant objects in the picture, united with a sentiment of repose and great breadth of effect.

To those who object to this as being far-fetched or fanciful, we would simply say that it is undoubtedly logical, and may be regarded as a system of mnemonics to impress certain rules upon the perceptive faculties of the brain; and, further, that the fanciful bears close on the poetic, and must contain the germs of some subtile charm. Be this as it may, if it induces thoughtful observation, it will have served the purpose we have in view.

## CHAPTER X.

Necessity of more General Knowledge—Light and Shade—"Making Ready" for Machine Printing—French Overlays—Printing Soft Wood Posters and Large Wood-Letter—Technique of Line applicable to other Professions besides Engraving—Rolling up Chalk-work on Stone.

IN our last chapter we showed that the study of light and shade was necessary to all engaged in printing artistic reproductions. Take, for instance, a letterpress printer having a block to print at press, with the engraver's proof on India paper as his only guide for "making ready." If our pressman comprehends the reasons the engraver had in his mind in producing the effect shown by the India proof, and understands all that goes to make up that effect, evidently he will be able to reproduce it by means of his "making ready" in less time, and with a more masterly result, than if he attempted servilely to copy the proof and knew no more why one part should be light and another full than that he saw it in the proof. And, further, we maintain that the eye which is not guided by knowing what to look for will not see the delicate shades of meaning, and cannot intelligently render them.

There are two kinds of shadow in nature, the one formed by the body itself being between the light and its own shaded side, the other by the intervention of some other body between the light and the object in shadow. Now, if our pressman knows this fact, and looks out for it in his work or making ready, he will find it of great help, for a shadow thrown upon another body has a sharp, distinct cutting edge, and therefore should never be softened at its edge, but kept crisp, whilst the shaded parts of a body standing in its own light, so to speak, is graduated off to nothing; and, therefore, in his "making ready" care should be taken to soften off from the darkest part down to the

lightest. To make this fully clear, we may lay down the simple rule, that shadow (or the absence of light, wholly or partially, on any surface) is of two kinds. The one, called the "SHADOW OF INCIDENCE," produced by the body itself intervening between the light and its own shadow side, is a soft gradated shadow or shade *fading at its edges to nothing;* the other, called the "SHADOW OF PROJECTION," caused by another body intervening and throwing its shadow across the object, has always *a sharp cutting edge.* The latter is, of course, the same shape as the body throwing it, as in the familiar instance of "throwing shadows" on the wall to please children; but is modified by the *form of the plane upon which it is thrown.*

REFLECTIONS are caused by contiguous surfaces catching rays of light and throwing them back again on to the shaded object, thus partially neutralising the depth of the shadow. But, as every surface absorbs some of the rays and only reflects back a portion of the light, it follows that *no reflection can ever be as high as the lowest light.*

It is one of the laws of optics that all shadows, both of incidence and projection, decrease in intensity in the exact ratio of the squares of their distances from the light. They are also still further modified by their distance from the eye in nature, *i.e.*, from the foreground in the picture, the reason being that more of the atmosphere intervenes, and the optic rays having further to travel produce a weaker impression on the retina than if they only came a short journey.

Shadows of projection are warm in a cold light and cool in a warm light. In colour-printing this fact is of great value to the printer in carrying out the various printings. He knows what to look for, finds it in his original, and takes care that each colour shall help to render its exact value towards the whole result.

These few simple laws are, in our opinion, absolutely necessary for any pressman or machine-minder to know, if he wishes to be expert in "making ready." In Paris "making ready" is done expeditiously and intelligently in the following manner: A three-sheet or four-sheet Bristol board is taken, and, after getting a fairly level impression of the block, by means of "*under* laying" at hand-press, an impression is pulled upon it in black or brown ink. It is

then laid down upon a piece of thick plate-glass, and, with a very sharp knife, the board is sliced away in the light parts, bevelled off where shadows of incidence require it, cut sharp through, perpendicularly, at the cutting edges of shadows of projection, scraped away in part only to give reflections, and glass-papered carefully with the finger and a small strip of glass-paper for softening edges and the ends of lines in sky or water. Then, to intensify the pressure upon the solid black portions and some of the darker tints, small pieces of India paper or tissue paper, torn with bevelled edges, are pasted over the board, one, two, three, or more thicknesses being used. When thus carefully cut out this solid "overlay" is available at any time, can be put away and re-used, when required, with the block itself. In the greater number of cases electrotypes of blocks only are used now, and the "under-laying" is done between the plate and the wood-mounting, and when the plate is again screwed down (screws are far better than pins), it is permanently ready for printing at a moment's notice, with its corresponding "overlay."

From this it will be gleaned that French printers prefer a hard, inelastic, unresilient pressure (*pression-à-sec*, or dry pressure as it is termed), and certainly their printing of fine wood-engravings leaves nothing to be desired, as instance Doré's various works, and Pannemacher's splendid illustrations in "L'Art." Whilst undoubtedly this method wears out both type and blocks much faster than an elastic pressure would do, it has its very great advantages, and especially for zinco work, which, from its extreme shallowness, prints dirty unless very carefully overlaid, and the zinc, being extremely hard, wears out more slowly.

For printing large posters, cut in soft wood, hard over laying and dry pressure will not answer, as it forces down the softer parts, leaving as ridges the harder parts, thus showing the grain of the wood. Some printers in America recommend underlaying only, and lay a sheet of india-rubber blanket *under* the block on the machine bed, which, being elastic, gives under the cylinder and enables the block to keep sufficiently in contact for a sharp impression, without being crushed by too much pressure. Such blocks should be cut expressly to avoid overlaying,—by having

such parts as are wanted to print light, *lowered*, which can be done by rubbing down the surface with glass-paper (No. 0) graduating the depth as required,—especially the ends of lines of tint which are wanted to print soft. If overlaying still requires to be done, it should be as sparingly resorted to as possible, being a prolific source of the inconvenience of making creases in the paper. If resorted to, we would recommend pinning on the cylinder, over the overlay, a double piece of French merino, tightly stretched so that it cannot drag, crease or shift about. Virtually, large wood type is the same as cut blocks, so far as the pressman or machine-minder is concerned, and these hints apply equally to such poster work, and will be found to effect a great saving of *matériel* in the wear and tear. This is, albeit useful, a digression which we trust will be pardoned, inasmuch as it shows practically the advantage of the workman understanding theory as well as practice.

The technique of line which, at first sight, would appear to affect the engraver only, has, in our opinion, a distinct bearing on the lithographic artist. We have often seen very clever pen-and-ink work on stone, which, from the fact that the artist had never studied the theory of line, was marred by his employing the wrong sort of line and choosing the wrong direction, thereby losing texture and failing to convey the perspective which his correct outline demanded. In many instances, the general drawing, and the light and shade, and the effect were good, but all was spoiled by sinning against the true theory of line, which was utterly misunderstood. Nor is it less evident, in chalk work on stone, that knowledge of the principles on which line is founded would be a most welcome adjunct to the technical knowledge of the "chalkist," as our American friends would say. Where no absolute necessity is forced upon the artist in the choice of direction for his line, we would ask him to remember that lines at right angles to the inking rollers of the machine, and lines parallel to them (laid in as the first tint), are always apt to gather and thicken up in machine printing, whereas diagonal lines keep clearer and leave the grain more open, and that in fining up, cross-hatching his lines at too acute an angle produces extra

difficulty to the printer. This applies only to machine printing. To the chalk printer at press, we would say,—Roll up, as far as possible, in such a direction that you cross the majority of lines at an angle, so that the "robbed" part of your roller is never presented to the continuation of the same line. This insures charging the whole job more evenly, and in less time.

It is comparatively difficult to describe in words the application of the principles laid down in the last chapter to chalking on stone; but, if our remarks are carefully re-read in conjunction with what follows, we trust the ideas will be made sufficiently clear to enable the "chalkist" to pursue the suggested train of thought and put it into practice. At the outset it should be granted that it is quite possible to produce upon stone a very fair representation of a "wash" without leaving any trace of line at all, thus obviating all necessity of studying the theory of line,—its direction, perspective, texture, and quality. We maintain, however, that, judiciously introduced, the work of the artist in chalk upon stone can be rendered much more expressive by the use of line in addition to the soft, wash-like, even tint of ordinary chalking. By this means alone can "texture" be obtained, and there are a hundred other opportunities of doing more for a subject than mere tinting it upon stone can do.

Pursuing the theory of line lying like a shadow upon every surface, let us show how this is applied, more particularly to the human face, each feature of which consists of several surfaces, each in its own perspective, and each surface blending softly into the next, and, moreover, not one of which is in any sense a flat plane, but is curved and "modelled." In portraiture it is not the proportions of the face, the distances between the eyes, nose, mouth, &c., upon which the likeness depends, because these vary very slightly indeed, but upon the rendering of the individuality of these varying surfaces which, in the aggregate, go to form the face. The prominence of the nose, cheek-bones, and brow and chin, can only be rendered on a flat surface by the shading, and, if the aid of line is called in, the changing direction assists the illusion sought to be produced, and distinguishes the minutest undulation of the modelling from the contiguous ones.

It becomes evident, then, that in order to secure, in the highest degree, a successful exposition of all the varying modellings of a face, we must find some basis or general harmony of direction whence the divergencies can best express, without incongruities, the departure of the surfaces from the direction of those in immediate contiguity, and again we must fall back upon perspective. It is not so easy to define the mapping out of the perspective of the face as it is in the delineation of geometric form; but, if we conceive a series of lines flowing over a face, following every undulation, and present to our minds the flat surface upon which each undulating superstructure is built, so to speak, picturing the shape and general direction that would be the result if each were cut off by a sharp straight knife (were it possible), we should obtain a glimpse of the sort of perspective the lines should take. Firstly, though straight on the supposed section, and running to the proper vanishing point of such inclined surface, they would be curved and modified by the projection of the superstructure, and by dying into the next surface and following the divergence necessitated by changing to a new angle.

Again, to estimate the average direction of line, conceive the face to be rounded out, filled up, say, with plaster of Paris or wax, until the general form alone remained, namely, something approaching that of an egg. Now, placing this imaginary form before one, in the exact position with reference to the rest of the picture perspectively, carve away, in fancy, the putty or wax from the face, remembering that, if the egg form had been covered with a series of parallel equidistant lines of uniform breadth, these lines would have diminished from the nearest portion to the eye, both in breadth and in distance apart, and would also have curved away instead of vanishing in a straight line, because the surface, being oviform, consists only of curves in all and every direction. If every line be conceived to be the edge of a plane down to its intersection with the real face under the supposed putty, plaster, or wax, that line of intersection would be the true line on the face which, influenced by perspective, would, in its modifications, become the correct ideal line of the engraver or the basis of shading for the chalk artist on stone.

To make sure of clearness in this explanation, suppose a bust to be carved in wood of the portrait, head and face, and the wood in which it was carved to be composed of thin veneers of black and white wood alternately in layers. These veneers would represent our ideal lines, and a photograph of this bust would give precisely all the varied undulations or modellings for the engraver to follow, not only for direction but also, as where receding surfaces were presented obliquely to the lens or to the eye, they would be foreshortened and become apparently thinner and more curved. This, to the chalkist, would be all, because his light and shade is produced by "washlike" work with the crayon; to the engraver the lines would again have to be thickened or thinned in an exaggerated manner, so as to also express the proportionate amount of light and shade, as well as the direction and the perspective undulations.

Once the truth of these theories has been made so evident as to make itself an ideal in the mind, and the eye has become, as it were, educated to see this ideal vividly as in the "mind's eye," and the rest is easy. Folds of drapery, waves of the sea, and all undulating, curved, or irregular surfaces can be prædicated, as it were, and the face, the most difficult of all surfaces to portray, can be readily rendered devoid of all incongruous anomalies of line. What is true of one surface is true of another, and the system of tracing the boundaries of a curved plane down to the ground plan on which it stands, or up to the plane of its average solid contents, or to that of a regular solid out of which it could be carved, is only a convenient system of mnemonics as applied to art. Anything beyond generalising would be out of place in this series of papers, but we trust enough has been said to facilitate and awaken correct and logical thought in this *rationale*. Its application is, in all its ramifications, a most interesting and absorbing pursuit, enabling the masses to see new beauties in the master's work, and to detect the means by which his illusions are produced, whilst it will give to those who seek to improve the talents committed to their care a sure and safe guide, whereby to regulate their fancy and to govern that delicacy of imagination that, alas! too frequently, is allowed to run riot, unchecked by its artistic possessor.

## CHAPTER XI.

Engraving on Wood — Surface Printing — Half-tone — Texture—Variety of Line—Perspective of Line—"Lowering"—Colour-blocks—Colour-printing—Bristol-board as a Printing Surface—Admixture of Litho and Typo — Zinco-process and Wood Compared.

LIKE the art of printing itself, wood-engraving has several rival pretenders to its invention. It may be that Egypt was its birthplace under the earliest kings, for Egyptian bricks were stamped from cut blocks of wood; or, it may be, that in almost pre-historic times the Chinese used engraved blocks for their pottery, before the art of printing proper was discovered. Whoever first invented printing undoubtedly owed half the invention to the art of wood-engraving, rude as it then was, for all the movable types were cut first in wood.

The principle of wood-engraving, as every one knows, is that the surface of the block produces black, the white parts of the drawing being scooped out, so that, when the block is inked, the lowered parts cannot come in contact, and thus are left white. To produce the effect of all intermediate shades between solid black and pure white, as in all engraving, a series of lines or dots, varying in distance apart and in thickness, must be employed. It is evident that, if half-tone be required on any portion of the surface, one half of the aggregate lines must be black and the other half white,—that is, that the lines and spaces must be equal; any intermediate shade between half-tone and black can be obtained by making the spaces narrower and the lines broader. Any degree of lighter tone than half-tone is got by cutting wider spaces with thinner lines between, and these may also be cut across in another direction, to form dots of various sizes. Thus effect can be produced. The wood-engraver, having tools of various sizes, and judging from the wash of indian ink drawn on the

block which he is reproducing, knows by experience what thickness to leave his lines. But he has something else beyond this to think of; he has to consider the relative distance from the foreground that the various objects occupy in nature, and in his reproduction he must somehow express this or his effect will not be satisfactory. This can be done by making the lines and spaces finer in such parts as are intended to be distant, and coarser in proportion as the objects occupy a closer position to the foreground.

Here is an opportunity of improving on the original drawing in wash on the wood, by expressing more than the wash does or can do. He can also obtain relief of objects from the background, intended to appear as if it were behind such objects, by cutting an extremely fine white outline round them, and stopping his tint lines at an almost imperceptible distance short of the object thus sought to be thrown up. The *rationale* of this is that the fine white surrounding line expresses atmosphere, close observation of nature showing that a film of air exists on the edges of every object; for in nature, as in geometry, there is no outline visible (a line having length, but no breadth), but merely a demarcation between one plane or surface and another. This boundary, especially in engraving, must be expressed in some cases by means of a fine line, in others by a strong line, and in others merely by a white line, as dictated by a man's artistic feeling.

But there is another power of line which taxes the mind and artistic instincts of an engraver. He must not be content with merely expressing the exact colour of a tone, nor with emphasising the proportionate distance of the object from the eye, he must also find means to convey to us what is technically termed texture, *i.e.*, what kind of a surface is intended to be depicted. This opens up one of the most subtle of the artistic instincts, that demands study and long practice to develop, affording an opportunity for refined pleasure, scope for the highest ability, vistas of thoughtful research, theoretical guesses, and experimental practice.

How shall the unending variety of nature's texture be rendered? how shall one rapid glance suffice to tell the stuff or material of which the object to be depicted

consists? Is the surface rough, smooth, bright, dull, polished, uneven, stony, wooden, woollen, silky, velvety, opaque, transparent, granular, luminar, porous, homogeneous, or any of the thousand-and-one qualifying and descriptive attributes of surfaces? Is not this a field wide enough and worthy enough to exercise the mind and the artistic temperament? Space will not permit anything like an exhaustive catalogue even of the guiding principles of expressing texture, to say nothing of the nice distinctions of the closely-allied, though often slightly-differing, line that should be used. Taste tempered by experience and long practice can alone supply the originality which is required. Our aim is not to write a treatise on the subject, but to give a popular *résumé* that will awaken and direct the current of thought in its own research into the more hidden things. As illustration, however, we may point out, that to give an idea of anything being, for an instance, wooden, one naturally takes the chief characteristic of wood as the basis to work upon, namely, the grain. A line which resembles the grain of wood will best express its texture. Again, take glass; it will occur to every one that its characteristic is hard smoothness.

Now, a perfectly straight line is hard, a line absolutely without any undulation, and a series of these hard lines, very regular in their distances apart, and all of exactitude as to thickness, will give the idea of perfect smoothness. But, in order to give "glassiness," one must express the high reflectiveness of glass, which observation will prove consists in sudden and abrupt refractions wherein a bright high light is contiguous to a bright black, the one being upon its exterior and the other its interior surface. There is no softening gradation between the two in certain points of view, because the whole of the light falling on one part, which would otherwise be dark from the interior absence of light, is all refracted to the eye, and the blackness of the inside remains everywhere else which is not affected by this refraction, concealing those rays which would otherwise reach the eye from the inner surface of the glass. Where a shadow of projection is thrown a similar effect is produced; but a shadow of incidence requires to be very carefully rendered, the lines "hard" and "straight"

must be thinned off to nothing, without the least wavyness and very mechanically.

As a further illustration, water, as in lakes and rivers undisturbed by wind, very often possesses the attribute of glassiness; but, although this "glassy" adjective is near enough for a poet, the engraver must not be led away from his logic into the error of literally giving to water all the attributes conveyed in the adjective "glassy." No one can call water "hard," nor can we conceive of a sheet of water being "thin" like a sheet of glass. Discriminating between those attributes of glass and water which are not common to both, the engraver must, of necessity, discard the "hardness" of his line, and dispossess it also of any tendency to represent "thinness," that is, of any attempt to represent the bottom surface parallel with the level top. He must take into consideration, also, a certain invariable characteristic of water, namely, its undulating propensity. A long undulating line, produced by the spaces not being parallel nor of equal breadth throughout their length, but narrower here and there, with a gradual sweep, will best express this, taking care to mark the reflections in all their varied gradations of tone.

As a rule, it may be laid down that, to produce an effect of texture, one must attempt to convey details of surface coupled with such other salient attributes as the material of which the surface consists is known to possess, discriminating between the qualities which are inherent to similar surfaces, and bringing out sufficiently strongly marked the main points of difference. But there is still another idea for the engraver to be guided by, viz., what may be termed "plane perspective," or determining the proper directions of his lining. Obviously, horizontal surfaces should be indicated by horizontal lining, perpendicular planes by perpendicular, and oblique by a slanting direction of line, with such modifications as may be necessary. For instance, to give vivacity to the play of light falling upon any surface, it is wise at times to break the lines here and there, and give a sort of alternately-varying direction, diverging slightly from the true direction as a whole. Curved surfaces, when presented full view to the eye, should be shaded by lines parallel to the axis of such curves; when

they are presented in perspective they should be treated horizontally, but instead of straight lines they should be curved in the direction of the curved lines forming its outlines or boundary; or, in some few cases, by converging lines vanishing to the same vanishing point, in order to enhance the perspective. Blue sky is always expressed by a wavy horizontal line, finer at the horizon and bolder as it gets higher up the picture; but clouds are diagonally cut, with a still more wavy line, finer on the retreating edges and bolder on the most prominent parts. All soft edges in an engraving will be found to print cleaner and softer by being lowered, and this will save much time and trouble subsequently to the pressman or the machine-minder, unless, as is too frequently the case, the electrotyper, finding a hollow place, knocks it up from the back, unaware of its useful purpose. This is done by shaving and scraping the edge of the part to be softened off, so that it is gradually lowered beneath the ordinary level of the surface, and then cutting the lines out to the ends as thin on the lowered part as they would have been if not so lowered. The two-fold effect is this, the ink-rollers do not get down with pressure enough to overcharge these ends of lines, and the pressure of the platten or cylinder is borne off by the rest of the block being higher; and this results in a lighter impression, besides preserving the block from being injured in its finer parts by crushing them down. This "lowering" would, doubtless, be more frequently resorted to but that the prices paid for blocks are generally too low to allow for it. Printers who can appreciate the saving of time in afterwards "making ready" would do well to order this; the extra charge would effect a saving in the long run without counting on the improvement in the appearance of the work when finished.

Many attempts have been made to cut blocks for colour, and this has been even partially successful; but nothing as yet seems to produce a result at all approaching the perfection of chromo-lithography. The reason is because half-tints of colour have to be represented by lines, and when two colours cross each other it is evident that the same direction cannot be preserved by both. There is a direct invasion of the principle of direction; a surface which ought to be horizontally expressed must, for instance, be

treated differently in each colour, marring both texture and effect; indeed, too often the texture of "parti-coloured tweed" is the result all over. When dots are employed the interstices which should be occupied by dots in another colour too often remain white by reason of the dots not falling in the right place, but upon other dots, thus blearing them. This is almost impossible to avoid, for, even if offsets of each colour were put down on the block, it would scarcely be possible then to insure their falling exactly between the dots of previous colours.

Another great fault in most of the chromo-typography hitherto published has been that the key, or black (or brown) block, giving the drawing and the form, too often contains too much, *i.e.*, it appears to have been carried so far as to leave comparatively little to be done by the colours; in fact, to have been cut as if intended as a monochrome block complete in itself. The study of good chromo-lithographs shows that the whole drawing is not attempted on any one stone, but is distributed over several, and the key is incapable of being used separately as a monochrome, what is called a "touch stone" being used to force the effect and cut up such parts as the colour stones do not sufficiently clear up.

We have ourselves, though not in small detailed subjects, succeeded in printing from blocks scarcely cut at all, but having the half-tones lowered and graduated so as to prevent their being more than half charged by the inkers, and in making ready only half brought up to the pressure, the result being that these half-tints are simply printed grey instead of full, resembling somewhat the appearance of a rubbed tint on a grained stone. If it is found necessary, a few strips of leather or card may be nailed or glued on the runners, so as still more to raise the inkers at certain parts of the stroke of the machine. In one case the key was drawn in chalk on stone, and five colours were printed from pine blocks lowered where necessary simply by rubbing down the parts with coarse glass-paper. Where the colours crossed, the absence of dots or lines and the peculiar granular appearance gave promise that the idea could be worked out to a very much greater extent. As to its being commercially advantageous no approximate idea could be

formed, all experiments being, of course, more costly than a regular system founded upon their after-results.

For producing soft flat grounds for pale tints of colour and other like purposes a very simple plan is the following, which almost any one can succeed in carrying out for himself. First, upon a smooth block of wood glue a piece of Bristol board, and, with a few sheets laid over it of softish paper and another block on the top of that, allow it to dry thoroughly under a press (an ordinary letter-copying press will do); then put down upon it an offset from the black form, and, with a soft pencil mark the size and form of such portions as are to be white. Carefully cut out these portions with a sharp-pointed penknife or the lancet-tool we have previously described, the whole of the parts being quite removed, with part of the wood beneath the Bristol board, where the size of the white space requires it. When the cutting out is finished, pour into a saucer sufficient silicate of potash or silicate of soda to cover the surface, and with a broad, flat camel-hair brush (similar to those in use for the damping of letter-copying books) very quickly coat the whole of it, taking care not to go over it twice, as it so rapidly coagulates on the cardboard. In a few minutes it will be dry, and, as the silicate hardens it and leaves a nice surface, which readily takes the ink or colour without allowing it to sink in, the result obtained is very pleasing. By using varnish alone without any colour, the exact appearance of a watermark in the paper can be produced; so that any firm, wishing their bills of exchange, cheques, or other forms, to be on watermarked paper, and, at the same time, not using enough to justify ordering paper to be specially made, can use this imitation merely at the cost of a second printing. If the cutting is cleverly done and care is given in the printing, the imitation is so close as to deceive any unsuspecting person.

There is another way of imitating watermarks known to experts, that is, by pressure under a thin zinc or brass stencil plate, the parts to be lighter than the rest of the paper being left and the rest cut away. The paper is then laid upon a zinc plate, the stencil placed upon it, and another zinc plate over all. It is then passed through a pair of calender rollers, and by the pressure the paper is

compressed into a thinner film where the stencil was in contact with it, and the imitation film where the stencil was in because the pulp of the paper is thin is perfect; for it is only the wires of the mark that the so-termed inner where it rests on after the pulp has been dried into paper. watermark shows

Returning, after this digression, to the Bristol blocks, which are certainly deserving of being board employed, it may be pointed out that the peculiar, sordidly granulated tint of colour produced cannot be rivalled by lithography. For reproducing illuminated cards, menus, programmes, ball or dance cards, and such similar work, it is as superior to stone, in purity and texture of colour, as anything can be, and in chromo reproductions of water-colour drawings any large broad flat wash can be faithfully rendered by using this process, say, for a sky, amongst the other printings. A great deal might be gained in many chromos by admixture of typographic printings in certain cases where it is better fitted to express certain effects than stone.

Wood-engraving has had of late years so many rivals, in one shape or another, that there is but little likelihood of its again reviving as a general medium for illustration, except, perhaps, in the very highest development it is capable of, such as first-class book illustration, in which field it must ever stand unrivalled. The masterly work on wood of men like W. J. Linton and the elder of the Pan nemachers cannot be excelled ; the portraits of Roberts, and the careful landscapes of Whymper and Cooper and others, the machinery of Langton and of Rimbault, are all that can be desired in their own particular sphere. No "process" block can compare with the work of such men. The plea put forth, that it is better to have the facsimile of the artist's work, pure and simple, without the intervention of the engraver, is a questionable one, and is not the fact in the majority of cases. The artist may be a master of the technique of painting, colour, effect, feeling, &c., and yet be the veriest tyro in the domain of line. His drawings would gain, in ninety-nine cases out of a hundred, by being translated into line by an engraver whose life study had been devoted to a subject of which but few artists know the simplest rudiments, and who sin unknowingly against its first principles.

The merely accurate engraving of facsimile, touch for touch, is not by any means high art; the rendering of a drawing in wash or a Zinco-process made photograph is art in the fullest sense. even then it may succeed in performing the former, though can never is hard, crude, and unpleasing; the latter it this must accomplish, even in the faintest manner, and for reason, that the most accomplished engraver can not produce with a pen or brush in ink that which would be easy to him with a graver. It is not knowledge only that is required, but power to carry out the knowledge, and, if the tools are not capable of carrying out intention, it is useless waste of time to attempt it. If an engraver, with all his technical experience, cannot do this, how can an artist, without such technical experience, succeed in the attempt? Another reason is to be found in the fact that zinc is a hard and cruel medium, cold, hungry, and unsympathetic, whilst wood is soft and yields itself to the purposes of the engraver with facility and ease, and in the printing with the resilience and elasticity so necessary for producing softness of tone in the impressions. Even electrotypes, being copper backed with soft metal, give off a harder proof than the original blocks, whilst zinc is dry and unyielding.

## CHAPTER XII.

Cutting Posters on Soft Wood—"Black Only"—"Half and Quarter tone"—"Tweed" Pattern—Laps—"Lowering" Edges—Four Colours—Breadth of Effect—Atmospheric Effect Softening Down.

IN wood-engraving proper the wood is end grain, that is, across grain, and the gravers cut equally well in any direction. In posters the grain is plankwise, that is, running all one way; gravers are, therefore, not available, and the work must be done with some other kind of tool. The graver and other tools used on boxwood give the requisite form as the basis for poster tools, but they must be grooved like a gouge or V tool. The drawing for posters is mostly done in facsimile in this country, because they are most often cut by wood-letter cutters, who are incapable of doing more than copying. Engravers on wood, as a rule, think poster cutting *infra dig.*, and have had no experience of cutting soft wood. There is, however, a standard of excellence to be attained even in this despised branch, were it encouraged. A wash drawing can be "done into line," boldly and well, by any one who cares to apply an engraver's knowledge to this purpose and who will undergo the necessary practice to enable him to get his hand in. The theory is the same, the manipulation only being different and on a larger scale. Instead of twenty or thirty fine lines in the inch, we have two or three and sometimes only one line and a space, though the form, direction, and quality are simply enlargements of the same theoretical line.

The great difficulty in all poster work is to produce half and quarter tones of colour in such a manner as to insure their perfect blending without irregularly forming clots of colour in places, or that regular mechanical and highly objectionable "Scotch tweed"-like appearance given by the lines of tint all crossing at similar angles. There

are two theories with respect to overcoming this difficulty. The one is to let down the colour sufficiently to make half-tone, by lowering the half-tone parts, and quarter-tone by cutting tints, not regular, but more like what would be brush marks in scene-painting. And here it must be insisted that scene-painting is the base of all poster work; they are, to all intents, the outcome of the same conditions imposed by the same problem, namely, to express to the eye at a long distance an effect dependent for its being striking, not upon minute detail, not upon soft blending of colour, but chiefly on breadth and force. Greys, so valuable as separate printings in chromo work, to be viewed by the eye at short range, are not only useless, but simply derogatory, in any poster that has to be viewed from afar. Distance and atmosphere soften the hardness and blend the sharp edges of colour; and if this be done by the artist first, instead of allowing it to be done by nature afterwards, it can only be by the sacrifice of force and breadth, and by losing the inceptive power of such detail as is suggested. In scene-painting broad flat masses of colour are laid on, high lights are superimposed, very dark shadows and exaggerated reflections do the rest. So it should be in posters; but, unfortunately, those who order them know nothing of this, and they condemn in ignorance as rough and coarse what is, or ought to be, at the proper distance, superior in all important respects to namby-pamby, carefully-finished, ineffective posters, which viewed from afar do not tell at all, and are lost amongst all the large type and brilliant colour that of a necessity surround them on the walls.

The other theory is to cut all lines so fine (and then crossing them to produce dots in each colour block) as to soften off whenever required, without crossing lines of other colours at regular angles. But, in order to do this properly, it becomes necessary not only to have an offset from the key or black, but also on each colour block an offset in its own colour of each of the blocks actually cut, and thus distribute the colours so as to avoid forming tweed-like patterns. In these days of perfect register this can easily be done on wood blocks, where on stone it would, from the nature of the process, be impossible, because offsets from stone must be dusted with powder colour first to prevent

them from being transferred, whereas the offsets for wood may be put down in ink, which does not injure the surface at all. When the various offsets are on the block each line of each colour distinctly shows, and in crossing these lines with another colour one can guard against stiffness and formality, so as to prevent the undesirable pattern appearing when printed.

A union of these two theories appears to us to offer the best results, because variety is always pleasing, and some parts could be treated in one way and other parts in the other way with advantage. The stronger the colour, of course the more difficult it is successfully to manipulate it, as red, for instance, the lighter and pinker tones of which necessitate that scarcely any of the red should be inked in such parts, whilst yellow, being in itself so pale, the demarcation between full tone and half tone is nearly imperceptible, instead of being hard and harsh as in red, unless carefully blended. A very great deal can be done in the printing by a machine-minder who attends closely to his inking, but it must be said that the inking arrangements in letterpress (and even in litho machines) are still capable of being immensely improved in many ways, notably in more perfect distribution and in some more perfect means of lifting off the inkers at portions of the form where less ink is required, and in lifting one, two, or three inkers, independently of the rest of them.

If we presuppose a drawing in wash on the blocks or boards for a poster, the manner of cutting it may be readily realised from the following practical description, in which let us imagine that four sheets, each 40 in. by 30 in. (*i.e.*, double-double crown), form the complete bill. Now, as the bill-poster pastes up the left-hand top corner sheet first, and then the next top sheet overlapping the first one about three-quarters of an inch, provision has to be made for this. Therefore, whenever there are two or more sheets in a poster, the work is duplicated on the narrow strip of the block forming the under-lap, so that, no matter where the overlap is printed off beyond the edge of the paper, it can, when pasted up, be readily matched with the work beneath so as to show no joint. The best plan to adopt is to rule in pencil a line three-quarters of an inch from the left hand

side of the board, and the strip between this line and the edge should be proved and rubbed down on the right-hand side of the second block, and carefully cut facsimile. In like manner the lower edge of the top sheet is the "paste-under," or "under-lap," and the upper edge of the lower sheets are the "paste-overs," or "over-laps," and should also be duplicated.

As every printer knows, sheets of paper, even in the same ream, vary in size, and in different reams this is more frequent, sometimes to the extent of a quarter or three-eighths of an inch; but, if the laps are thus cut in duplicate, the joints will be perfect, no matter where the edge of the sheet comes for the print-off, because the bill-poster can readily find the exact spot on the "under-lap" that will match his "overlap." The draftsman or artist who makes the drawing on the boards or blocks should make this pencil line, or lap-mark as it is called, the limit of his drawing on that one sheet in each case, the engraver being left to duplicate it from the rubbed-down proof of the corresponding edge of the next sheet to it. If this system be adopted and strictly adhered to, there need be no confusion in the mind about laps, which is so generally a stumbling-block to inexperienced poster artists.

The first requisite of a poster is, that the drawing itself shall be correct, the figures accurately proportioned, and the perspective properly given, as any faults in these directions are sure to be seen at a glance; but once these points are achieved the rest depends upon the force and breadth of the drawing. The key being black and white may readily err in two ways, namely, either in being so dark over the colours as to produce the appearance of smudgy or dirty colouring, or in being so "cut up" by the introduction of detail as to lose all breadth. Thus, the artist should guard against doing all the work in the black instead of leaving some of it to be done in the colours, at the same time losing all minor detail by indicating it instead of putting it all in. When the drawing is complete as a suitable key, the engraver, before cutting it, should adopt some plan of direction of line that will be harmonious throughout and not betray him into any too sudden changes of direction afterwards. His solid black portions should be

one can pass by without seeing—which, after all, is the true criterion of a poster's value.

With respect to comparative cost between litho posters and letterpress there is but little to choose, except that for long numbers wood is cheaper, and for orders that are likely to be reprinted; for the wood blocks can be kept in stock, whilst large stones are too expensive to lie idle. Blocks use more ink, but it is a cheaper kind; they can be printed upon cheaper paper, and at a much greater speed; the bills are stronger on the walls, because the paper is better covered with a thicker layer of ink. Block posters do not bear close inspection so well as litho posters, while there is a prejudice against block, owing to the bad work which has been so often turned out by those utterly incompetent to attempt it, and also owing to the bad drawings and designs that have been used; but, class for class of workmanship, good block posters can hold their own against stone. Even the best litho posters, both English and American, are tame at long distances, and, other things being equal, the same cannot be said of block. In the time taken up in making up stones and in cutting blocks there is scarcely any difference, on an average; if anything, wood blocks cost, perhaps, slightly less in the first instance; and, as the "life" of a block, if properly used, is from fifty to sixty thousand, that is, five or six times that of a stone, in some cases there is an immense advantage over lithography in very long orders.

Sycamore, although much sought after by London printers for poster blocks, is too hard to allow any freedom of execution. We agree entirely with the Americans in their preference for best soft yellow pine, which, with proper care, is very superior to any other wood for the purpose.

## CHAPTER XIII.

Zincography—Zincotype—Polished Plates—Graining for Line or Ink Work, and for Chalk—Whites may be stopped out with Gum—Wiping-out Mistakes—Etching—Rolling-up—Polished Plates for Zincotype—Transfers to Zinc—Transfers from Zinc to Stone—Biting-up Zinco Blocks—Re-rolling and Re-etching.

THIS subject, concerning which questions have been numerous, and repeatedly put to us, both privately and in our public capacity, will, doubtless, interest a wider circle of readers, and we have, therefore, dealt somewhat more fully with the matter in this chapter than we otherwise should. We may add, that the whole process of making zinco-blocks is fully described and illustrated in the handbook on "Zincography," published at the price of half-a-crown by Messrs. Wyman & Sons.

The questions put by our correspondents as to Zincography, which means drawing upon (in line or chalk) zinc plates, and printing therefrom, as a substitute for stone, would seem in some cases rather to refer to zincotype blocks; but, as the two processes are very similar up to a certain point, we give the following description.

The zinc plates for either, are sold ready polished, and differ only in thickness, the zinco block being four times as thick as those used for drawing upon.

The expense of large stones for the rougher kinds of litho work, and more especially for the commoner classes of posters, has led to the adoption of zinc plates in lieu of stones both for jobs in line and in chalk. Whilst the work, when executed in the most capable manner, cannot compare favourably with even careless work done direct upon stone, yet often it may conveniently be resorted to for coarse work; and the following hints as to the *modus operandi* to be followed will, doubtless, prove useful.

Polished zinc plates are unfit for the purpose in question. The surface must not only be perfectly level, but it must be "grained," just as a stone must be grained for chalk, even if the job has to be done in line; for, otherwise, the zinc, whilst it has the property of absorbing and holding grease, cannot be, as it were, disinfected and kept pure from grease, unless the surface is roughened, and rendered so porous as to imbibe the preserving gum and other re-agents necessary to resist the oiliness of the subsequent printing-ink.

It must be remembered that the zinc for drawing upon is not ready for graining until it has been washed with strong potash and rinsed in clear water, and the graining must be done with sand and water, in a manner similar to that adopted for the stone. For convenience of working, the white portions may be stopped out as on stone, but the gum used should have a few drops of glacial acetic acid or nitric acid mixed with it to the strength one would use for a "strong etch" on stone.

It will be seen, from what we have said, that zinc is not nearly so susceptible in its nature as stone, which will account for its being inferior in its results as compared with those obtained by lithography proper, and it therefore does not need so much care in the process of drawing. Touching with the hands, and the breath or "cough-spots," do not mar the work to the same extent that they would upon the stone, still it is advisable to take ordinary precaution to avoid their occurrence. This may be accomplished very readily, by having a hand-rest, or bridge, made of wood, about 5 in. or 6 in. wide, with two thin pieces nailed under each end, to keep it from contact with the plate. Such a hand-rest is a great convenience in chalking upon stone, as is generally known, but a further use of these rests not ordinarily practised will be found of great service. They should be planed quite smooth, glass-papered on the upper surface, and afterwards well rubbed from time to time with powdered French chalk (talc), which prevents any litho-ink or dust from resisting the free motion of the hand over the "rest. This talc powder makes the "rest" so slippery as to destroy all friction, and thus allows the most perfect freedom of the hand in any given direction.

If it is desired to produce chalk work on zinc, the grain requires to be proportionately sharper than that of stone, or the chalk cannot be properly worked-in to resist the etching; and, whilst with careful printing any mere surface-chalking, not strong enough to resist a proper etching, may, on stone, be humoured to some extent, this is not the case with zinc, which is peculiarly liable to gather and fill up, thus becoming often a solid black mass, instead of an intended half-tone. This difficulty has induced many to pull transfers from zinc plates and put them on stone for printing from, so as to obviate its filling up, especially in machine printing; and it must be admitted that the extra cost of transferring is repaid by the extra ease and speed of printing from stone, in comparison with machine printing direct from the plates, while, moreover, the quality of the impressions is decidedly better, notably so in the case of long numbers.

Whenever practicable, line work or stipple is to be preferred to chalking, when zinc plates are resorted to; for, as the effect of the finished work has to depend solely upon line, the line work should be done as well as possible; and considerable experience compels us to say, that bad line in these jobs is the rule rather than the exception.

Lining on zinc is capable of great enrichment by means of cross-hatching, that is, of crossing and re-crossing lines in different directions; indeed, all the embellishments of etching or pen-and-ink drawing are easily reproduced with a fine brush upon zinc, and a little practice is certain to suggest to the artist many little improvements as he proceeds, until he finds it a congenial and very interesting occupation, affording a good deal of scope for his powers.

For colour work, good effects of half-tone and quarter-tone for blending may be readily obtained by "splashing" the ink with a tooth-brush on such parts as are required to "soften off." Any shade can be secured with a little practice, or, if preferred, line or stipple may be resorted to.

From the foregoing it will be seen that the chief difficulty is in the graining of the plates; and, as this also applies to stones, the invention of some easier and cheaper way of effectually performing this necessary work than that now practised is a great desideratum. Hitherto attempts to

grain by machinery have not, generally speaking, been very successful; we believe the sand-blast has also been tried without practical result, and, therefore, it remains an unsolved problem well worthy the attention of inventors.

A tracing made with "crayon conté" will rub down easily upon zinc, and will not affect the plate, and any sketching in "conté" upon the plate will do no injury, while, at the same time, it allows of mistakes being rectified. If it be necessary to alter anything, benzine, applied with a soft piece of rag, will remove all traces of ink or chalk, and leave the surface of the zinc, when dry, ready to work upon again without showing the least trace in the proof of having been altered. "Turps" may also be used in like manner, but it is neither so effectual nor so clean in its action as the benzine; it is only, therefore, when benzine is difficult or impossible to procure that turpentine should be resorted to. Railway plans are frequently drawn upon zinc instead of stone, and, having regard to the repeated alterations which have to be made in them, and to the ease with which they can be thus effected, zinc plates are certainly particularly well adapted for the purpose. Again, in every case where reprint orders are expected, zinc plates offer much greater economy of cost and space in storage than the heavier and far more expensive stones.

This latter consideration leads us to speak of the use of large zinc plates for poster work. Quad-crown plates being worth only about 7s. or 8s., as against from £3 to £5 for a similar-sized stone, and the zinc plates being so light and portable, they find, perhaps, their most legitimate employment in this class of work, where defects are, moreover, not so readily observable.

Another advantage in this direction is that they may be placed upon any ordinary easel, and drawn on much more conveniently in an upright position than if laid upon a bench, and the effect, as the work proceeds, can be readily ascertained by stepping back to some distance, from which to observe how it looks. If this plan be adopted, the hand-rest may be hung on to the top edge of the plate and slidden along as required; or, better still, a saw-groove may be cut to the depth of a quarter of

an inch into the side of the end piece, nailed under the rest so that the edge of the zinc can slide in it. By using the straight edge of the hand-rest as a guide, after wiping it over with powdered talc, and drawing the hand holding the litho-brush straight up or down it, keeping one uniform thickness of line, any vertical line may be quickly and easily drawn without any other ruler being used; hence vertical tints, *i.e.*, an assemblage of vertical lines, can be very quickly drawn in, and a slight waviness given to them if required. By turning the plate so that the horizontal lines become for the moment vertical, the same thing can be done with them,—as a sky, for instance,—and it is astonishing how easily and well this sort of lining can be done in this manner. It appears so difficult at first, and, in a few minutes, becomes so easy, and is done so quickly, that one never seems to feel the monotony of it.

When the drawing is completed, take a solution made as follows, and etch the plate with it for ten minutes, not longer:—Put two dozen nut-galls into a saucepan, preferably one glazed with earthenware, and cover them with a pint of water; simmer over slow fire until it is reduced to half a pint or rather less; strain through fine muslin into a clean vessel, and let it stand until cold; or it may be kept in a stoppered bottle. Take of strong gum and the above tincture of galls equal parts, and add a drop or two of glacial acetic or nitric acid; the former is preferable, as in washing the acetate of zinc is more soluble than the nitrate.

This solution should be rapidly passed over the plate, whether chalk or line, just as the "etch" over a stone. After ten minutes' etching, wash off with a clean sponge and plenty of water, and roll up in the usual way, bringing it up with a roller. Some prefer to allow the plate to dry all over during the rolling up, and keep rolling until the whole plate is one black mass, when they wash out the job with "turps" and water and roll up again; others are careful to prevent the plate drying in the white or clear parts by wiping very frequently with a very slight etch of gum and acetic acid, feeding the job with the roller all the time, in between. If a transfer is required, a few impressions should be run off before again washing out, when the job will be found strong enough to roll up in re-transfer (litho) ink,

and the transfers pulled may be put down upon *polished* zinc for the bath.

Zinco-blocks for letterpress printing *must be polished*, unless perhaps for coarse poster work. The grained surface would not answer in the printing. To polish the zinc, take the ordinary pumice-powder, very fine, and, with a piece of soft, preferably linen, rag and a little water rub it down till an even polished surface appears; after which, with the same powder, *dry*, complete the polishing till the surface reflects like a mirror. Immediately put the transfer down exactly as if it were stone; then, before rolling up, dip it in a very weak bath for a minute or so, and rinse and dry without heating. It should not be washed out, but rolled up in litho ink, and may then be put in the trough and rocked in the usual way, being heated from time to time, and rolled again with the ordinary varnish.

Sufficient care is not usually exhibited in England in biting up these plates for zinco-blocks. The writer has had the advantage of seeing the process as conducted in Paris, where the plates are carefully examined through a strong magnifying-glass, and, if any tendency to undermine the lines is shown on arriving at a certain depth, the operator takes a varnish brush and protects the shelving sides with it, and also touches up any parts of the surface which seem feeble. If any specks of "scum," or "dirt,' adhere to the sides of the lines, or amongst the chalking, he takes a graver and cuts them away, taking care to touch each graver cut with varnish, so as to prevent the subsequent bath from undermining the line. To this care is due the superiority of the French, and for that matter the American, process-work. Some houses, before subjecting the transfer on zinc to the weak bath, etch it with the tincture of galls and gum for five or six minutes, which will clear away all scum, and then rinse off with cold clear water, and immerse in the bath.

Almost every operator has his own favourite mixture of ink for rolling up the zinco-block during the biting-up, which he pretends to keep a profound secret; but anything which will feed the job, and prevent the acids in the trough from impoverishing it, will answer the purpose satisfactorily. Cobbler's-wax resin, and white or yellow wax, all of which

are rendered fluent by the heated plate, in various proportions of admixture, form the bases. Like the earlier receipts for transfer paper, re-transfer paper, transfer and re-transfer ink, and the photographic processes of earlier days, there always has been an amount of pretended secrecy that imposed upon the credulity of the many, but had no reality about it. Once the principle is understood, the rest goes without saying.

## CHAPTER XIV.

Zincography (continued)—Chalking on Zinc, Etching, and Rolling-up —Transfer to Stone—"Flatness"—Contrast between Zinc and Stone—"Litho-plate"—Description of—Chemical neutrality of, towards Colours—Bed for Litho-plate—Litho-plate as a Zincotype—Storage—Transmission by Post, &c.—Stone Supply—Relative Cost.

SUPPOSING that a job to be done on zinc plate has either to be wholly or in part in chalk, and that the proper grain is obtained, the artist will require some little practice with the chalk, as the feel is so different to chalking upon stone,—the metallic contact is not so pleasant, and there is a tendency to filling up the grain. It is desirable, therefore, to have a rather coarse and open grain than a fine one, which permits the use of No. 3 chalks, the points for working up and finishing being kept nice and sharp. Flat chalking may be resorted to when large flat tints are wanted, but rubbed tints are not usually successful on zinc, especially if they are to be machine-printed direct from plate. It is recommended to transfer to stone for printing; if for chalk work, the stone should be half grained to keep it from filling up and to avoid the flatness that chalk transfers always possess when put on a polished stone.

When the drawing in chalk, or chalk and ink combined, is completed, it should, before it is rolled up, be etched with equal parts of strong gum and tincture of nut-galls, to which a few drops of glacial acetic acid have been added, care being taken that the acid is weak. It is better to under-etch than over-etch at this stage. The plate should not remain longer than ten minutes, after which it should be washed off with a clean sponge and a free supply of water. It may then be brought up with a roller, and, when

fully charged, should be dusted with resin finely powdered, and again etched as strongly as it can bear with the same solution of nut-galls, gum, and acid; but the latter may be used rather stronger than before. It may be mentioned that it is due to the chemical action of tannic acid (which is obtained in the tincture of galls) upon the zinc which prevents its affinity for grease coming into play wherever the solution touches the metal, but where the chalk or ink has impregnated the plate the solution cannot attack it unless the acetic acid is too strong.

We all know that in transferring chalk drawings to polished stones "flatness" is the invariable result. The cause of this may be illustrated thus. Supposing that we take an oil painting which it is intended to reproduce in chromo. Let us suppose each tint to have been conscientiously rendered, and the proof to be unexceptional as to colour, yet we shall be obliged to confess that there is something wanting,—in short, there is "flatness." In the original there is a valuable relief where the paint has been laid on thickly; very slight and scarcely perceptible shadows are cast by these projections, which have the effect of redeeming it from flatness and a sort of tea-tray smoothness. If, however, an embossing stone be used, the proof shows imitations of the brush marks and the projections of the thick paint; here and there the threads of the canvas are also imitated and flatness entirely disappears.

Chromo paper is made with a punctured surface to secure the same object, and every water-colour artist prefers a rough-grained paper on which to work, for this very purpose. Hence, if we wish to avoid flatness in transferring chalk from a grained stone, we must use a slightly rough stone upon which to put down the transfer and etch it strongly under resin, which will have the effect of slightly embossing the paper during printing and thus prevent any appearance of flatness.

It will be seen that zincography, whilst its many imperfections preclude its more general employment, possesses some advantages over stone. We will just contrast the two. Stone is better adapted for both working upon and printing from; but it is expensive, bulky, and very heavy, and, from its brittleness, cannot be utilised for printing, even if slate

backing is resorted to, after it has been about half ground down in thickness; it is therefore subject to about 40 per cent. of waste, and probably it costs at least five times its original cost in transport, by which we mean that for every job men must be employed in shifting it about from the stone-grinder to the artist, from him to the press, from the press to the machine, and from the machine to the stone-rack, whilst the labour that would require three or four men for stone, one boy could easily perform when zinc is used. The amount of space for stone-storage, the risk to buildings of the immense weight upon the floors and walls, are in favour of zinc. But, again, zinc plates, even with great care, are so liable to corrode, that but little reliance can be placed on a job which has to be stored for any length of time being found, when required, to be fit to print. We cannot wonder, then, that zinc is not accepted to any great extent as a substitute for stone, nor that the opportunity offered to inventors in the direction of finding such a substitute has been seized, and we will now give to our readers some account of "Litho-plate" which, after careful investigation, appears to us to possess all the advantages as to lightness and convenience which zinc offers, combined with nearly all the perfections of stone, with none of its drawbacks, and we have to acknowledge the courtesy and kindness shown by the "Litho-plate Company," in fully explaining this invention and facilitating our severe critical examination of the litho-plate, which, on its first introduction, was duly described in the PRINTING TIMES AND LITHOGRAPHER.

Although litho-plate has, during the past three years, become very generally used, there are as yet, no doubt, many thousands who have but a very vague and confused idea of what it really is, and of what utility and what economy can be effected by its employment. It needs no apology, therefore, for placing candidly before our readers a reliable description and accurate facts relative to its practical capabilities, the more so, as any one having any doubts can verify for himself, by experiment, the accuracy of the following account.

A thin metal plate—zinc being used for cheapness and general convenience—is taken, and upon this is deposited

in some way a coating of chemically pure lithographic stone. It is claimed that, by reason of this film of stone being pure throughout its whole surface and perfectly uniform in texture, better results can be obtained than from ordinary stones, because it is very rarely that one finds a stone equally good throughout, and free from veins, faults, and chalk, homogeneous and of one texture, which must vary in the very nature of things; and, even if we do find a stone perfect at the surface, who shall say that, when it is ground down, defects will not be brought to light? The film just mentioned is exceedingly thin, which secures an actual advantage, because, after the drawing is done or the transfer is put down, the solution used to prevent the greasiness from spreading permeates right through to the zinc; hence the grease can never spread below the surface and then strike upwards, as it undoubtedly does in stones, locally, where extra porousness occurs in places. It will be granted, therefore, that, given a pure, equable film of stone, the result ought to be superior to ordinary stones taken from natural beds, and therefore chemically impure and partially impregnated in parts with other bases. We have seen transfers and re-transfers on to litho-plate, in which it was impossible to notice, even with a strong glass, any appreciable difference at all from the original.

Another point in favour of litho-plate which is, of course, prospective, is that, with respect to the recent improvements in transferring which depend upon rendering the surface sensitive to light, or, more correctly speaking, to the actinic force contained in a ray of light, they can be thoroughly guaranteed on litho-plate; indeed, so capable is it of being thus sensitised that the plate may actually be exposed in a photographic "pressure frame" under a photographic negative, and after being developed become a photo-lithograph; hence it is established beyond doubt that any transferring process which depends upon sensitiveness to the actinic rays is more certain on litho-plate than upon stone itself.

The foregoing remarks must be clearly understood to apply only to litho-plates in which the stone film has been deposited upon a slightly-grained zinc plate, intended to supersede polished stones either destined for drawing upon

in ink or for transferring upon, in contradistinction to grained stones.

Any one who has ever seen a litho-plate would, at the very first glance, concede the impossibility of graining the stone film, and it is, therefore, evident that anything in the way of graining must be done upon the zinc before the litho deposit is attempted. This is a grave difficulty, because, as every practical lithographer is aware, to grain zinc for chalk is always a hazardous thing to attempt. The nature of the metal is hard and granular, and the requisite sharpness is difficult to arrive at; but, even supposing this to have been surmounted and the requisite sharpness to have been attained, depositing the stone film upon it must deteriorate from the sharpness to an appreciable extent and tend to fill it up, as the deposit falling perpendicularly upon oblique surfaces must ultimately, as particle after particle falls, were the process continued long enough, tend to close up the "valleys" of the graining, although we are informed this is not the case in practice. Hence we are compelled to say that, whilst litho-plate, *per se*, is quite equal to, if it does not surpass, stone itself for transferring purposes or ink-work in line, stipple, "air-brush," photo-litho, &c., and ought entirely to supersede stone, yet, until further improvement has been made, it cannot be said to compete favourably with stone for chalk-drawing, although for transferring chalk it may be equal or even superior.

It is not for us to say whether it will ultimately be so improved because the manufacturers of litho-plate do not as yet profess to supply plates for chalk work. We cannot, however, see any great inherent reason, beyond that above advanced, why this difficulty shall not eventually be overcome; and this may be modified in some way, either by some better way of graining the plates, by machinery or otherwise, or some improved means of depositing. In every other respect litho-plates, as issued for ink-work, are simply perfection, and embody all the advantages that are claimed for them. They have a very great advantage over zinc plates for storage, as, unlike them, they never corrode or change: we have seen plates, which have been, we are assured, hanging up three years without being washed out and "fed" by being freshly rolled up, and they did not show

the slightest deterioration. For colour-work also, which cannot be printed from zinc, owing to the chemical action set up by the metal upon certain of the mineral colours, litho-plates, owing to the protecting stone film, are absolutely innocuous to such colours, for they do not decompose either vegetable or mineral colours. The results we have seen of first-rate colour-work done on these plates by the chief colour-printers in Manchester, Liverpool, Birmingham, Nottingham, Leeds, Bradford, Bath, Leicester, London, and other towns, leave nothing to be desired in this respect.

In printing at press the litho-plate is simply laid down on the face of a stone, which is first wetted, and the consequent exclusion of air beneath it is quite sufficient to prevent its slipping about and to hold it in its place for printing, but, of course, for machine printing a special bed is required on which the plate can be fixed down, which is effected by bending the edges at the "pitch" and the "leave" down at an angle and securing them by means of clips to the bed itself. Once the machine is set, one plate can be taken out and replaced by another, without loss of time or having to re-set the machine.

Whilst necessarily the processes of etching and rolling up or of transferring, which very closely resemble similar operations on stone, demand from the printer some little instruction and practice, at first, to enable him to produce good work, yet, when he has once acquired this and can consider himself as proficient on litho-plate as he was formerly on stone, no reason exists for supposing that these manipulations require either greater care or take up more time than were they done on stone; and we have been assured the results are better.

We are informed that by depositing a stone film upon thicker zinc plates, putting down transfers, and then, after rolling up, removing the white parts of the film with weak acid to commence with, and afterwards treating in the usual way for zinco-blocks, cleaner and sharper results are obtained than if the ordinary zinc were used as at present.

Of course, for storage purposes, litho-plate must be allowed to offer advantages, other things being equal, the

weight, bulk, and cost being so much less than those of stone of equal surface area, whilst not at all susceptible to corrosion like zinc plates of equal or nearly equal weight and bulk, and in comparison being superior to zinc in even a greater degree than is stone for the purposes of lithography. As an instance of the room these plates occupy, we find that about thirty-two occupy the thickness of an inch only.

For convenient transmission, as parcels, these plates cannot be over-rated. We know of several establishments in the provinces who commission artists in London to prepare chromos in ten, twelve, or more printings upon litho-plates, and have them sent to them by rail or parcel post, at a trifling expense, to print. This is a powerful incentive to adopt them, but it is exceeded by the consideration of the sources of stone supply, which, as we have known for some time, are being steadily and rapidly exhausted, and that without any probability that new quarries of this valuable limestone will be discovered. What, we have often asked ourselves, will be the fate of the art of lithography when the last stone in the quarry shall have been exhumed? It is self-evident that some substitute will have to be discovered or invented. The only approach in this direction has been to substitute zinc for stone, and, as we have pointed out, it is a very inferior substitute, hence its very limited employment until the introduction of the litho-plate. What we should save, as a nation, by using these plates made on British soil, instead of paying to Germany large annual sums for litho-stone, we cannot estimate.

The prices of litho-plates are very much less than the cost of stones of similar area, and, whilst we admit that the stone film answers only for one job, yet they may be re-coated for almost the cost of grinding and polishing or graining a stone; whilst, in case of having to make alterations on litho-plate, they can be even more easily made than on stone; and, for small editions, one plate might be used more than once if carefully handled and the job not left on too long.

We hope, therefore, that, before long, further improvements may be made, which shall enable these plates to be universally used for chalk, for which they are

not, as we have seen, as yet adapted; in all other respects, however, we are thoroughly satisfied that they possess all the advantages, and none of the drawbacks, of stone itself.

In Germany, litho-plates are more widely employed than with us; there they are used for engraving upon instead of on stone, a branch of lithography comparatively but little practised in this country.

## CHAPTER XV.

Chalking on Stone—Line applied to Stone—Direction—Thickness—Movable Vanishing Points—Texture—Flesh—Key-stones and Colour—The "Air-brush"—Line applied to Chalking Colour Stones.

IT is no part of our programme to reproduce in another form a technical treatise on any one of the branches of printing, but in these papers we simply record facts and opinions which, whilst akin to text-books in their scope, are certainly of a supplementary rather than of a substitutory character. We shall not attempt, therefore, to minutely describe the *modus operandi* of chalking on stone, but throw out a few hints which may or may not have been given elsewhere, but which, if they have been given, seem worth repeating.

In the first place, we would counsel all in the profession as chalkists to study "line," and this for a twofold reason. Firstly, it is pre-eminently a study that involves the creation of habits of artistic thought, just as that of mathematics creates habits of accurate study and logical reasoning; and, secondly, because, apart from these habits, the application to stone, where practicable, of what we have shown, is a great and powerful aid in other branches of art, and will be likely to improve the style and heighten the value of this class of work.

At first sight those who are in the habit of chalking on stone will not, perhaps, be ready to admit that it matters at all in what *direction* they lay in the first breadths of shadow, since ultimately these lines, whilst crossed and re-crossed in other directions, will form an even tint, well worked into the grain of the stone, in which all direction of line will cease to be perceptible.

Now, we shall endeavour to show that an additional value

will be given to the work when finished if, instead of laying in a lot of lines in a happy-go-lucky way and in any direction, an intelligent knowledge of the direction guides the artist. Let us instance a portrait. It is quite true that, so long as the head and face are shaded up to the right strength and the drawing kept, the portrait will come. But our contention is, that if a good portrait in line be kept before the artist during the work, and the direction followed in the laying in, subsequently crossing them in two directions which shall be the two *extremes* of which the original direction is the *mean*, the result will have this higher value as a work of art, that the *feeling* dictating the line will be manifest, for the direction, whilst it does practically disappear, still has an undefined influence, subtle, invisible, yet felt.

Direction is only one of the attributes of line, thickness is another; for its thickness enables line to express its own perspective, and, relatively to other lines, to indicate the position of that particular plane in the picture it is intended to convey an idea of to the mind of the observer. As we have shown in a previous chapter, the finer the line the more distant does the part so treated appear; yet, in nine out of ten chalk portraits on stone, the background is actually invested at some pains with coarseness of treatment in order to make the face look fine. We have also shown that in theory the portion of any surface coming nearest to the eye should have a bolder line than where such surface was receding, and that thinning the lines as they appeared to be receding gave the effect of their really so receding. On a curved receding surface the perspective of each line, instead of vanishing, as in plane surfaces, to a fixed vanishing point, must be held to vanish to an ever-changing one, influenced by the rotundity or curvature of the surface under consideration. To make this clear, take the mathematical construction of an ellipse. Here, instead of one fixed centre, as in the circle, we have two foci, and the production of an elliptic curve depends upon the one focus influencing the other. So, in conceiving a line upon any curved surface, the vanishing point must change its position on the horizontal line as the angle at which the curved surface varies more and more from the plane of the

picture. To fix this firmly on the mind, consider every curved surface as an agglomeration of surfaces, all of which are infinitesimal planes. It will be evident that each of these planes, being at different angles to the picture plane, will possess a vanishing point of its own ; and, further, as these agglomerated planes are imaginary, and in reality form but one curved surface, it will be perfectly clear that we can only logically regard the innumerable vanishing points as one movable point travelling at a speed proportionate to the rapidity of the curve of the surface itself approaching the centre of the picture as such surface becomes more and more rapidly receding from the eye. Now, in laying in curved lines, with this theory prominently before the mind's eye, and bearing in memory the fact that lines vanish in perspective just as planes do, the artist will carefully use more and more pressure on the parts of each line nearest the eye, and gradually make the receding parts of each finer and finer. If this be done in crossing them, as before pointed out, the result will be a soft curved modelling, executed in less time than the usual method, and conveying logically an artistic feeling and appreciation of the attributes of such a surface. Thus, the brow, the cheek, the nose, and chin, and all the lesser curved modellings that go to make up the face, may be imaginatively treated, and the power of treatment resulting from thought and knowledge, it is evident, must enhance the artistic value of the work. That it also enables the artist to finish it in less time can be proved in two ways, firstly,—by showing that if, instead of having to stop and think, a man goes steadily on with a settled aim in view, he must save time ; and, secondly,—by actual experiment.

But line has another attribute besides these two, that is, the power of expressing texture. It is almost impossible to describe in words what sort of line will best express the idea, for instance, of flesh. We can only refer the reader to the host of well-engraved portraits, both on wood and copper or steel, an inspection of which will show exactly that which best conveys the idea of flesh. The attempt to reproduce similar line on stone will, perhaps, not succeed, we do not assert it to be possible, for it must be evident at the outset that no drawing of lines, however good, can

compete with the graver; still the attempt will modify the work to some extent, and produce still greater excellence than if it were never made.

Flesh is, of all textures, the most difficult to attain, whether it be in painting, in engraving, or in drawing. On stone, other textures, such as velvet, glass, fur, hair, cloth, lace, &c., can be obtained with ease. By employing the right direction and the proper quality of line, texture can be also obtained quite as readily as if the theory of line had been entirely disregarded. But, putting the matter at its worst, and granting, for the sake of argument, that our theory is fanciful, there is one great truth that every student will admit, that in the pursuit of knowledge the mere fact of research will bring many parallel facts to light besides those which are the immediate object of particular study. Whilst searching for gold and diamonds one may turn up some other precious stone scarcely of less value, or come across some other metal intrinsically inferior, yet amply sufficient to repay the costs of the search. To the chimerical pursuit of the elixir of life and the philosopher's stone through the romantic middle ages, are due many of the most wonderful discoveries in chemistry and their most recent useful applications. In other words, whilst investigating the laws which govern line, one educates the mind and developes the artistic feeling; every effort onward gives new power, and, amid the cares of the city life and the struggle for a place amid the throng, one's daily routine derives, at least, a new and pleasurable interest to counteract in some measure its disappointments and its monotony. Nor is this all; we would fain see that which seems destined to become a lost art taken up before it dies and live again in another form. There is no demand for line engraving now. Gradually becoming more and more neglected, line engraving is becoming obsolete; with its power of expression of artistic truths it ought not to be allowed to lapse also into oblivion, but be absorbed by some kindred art and live on in another form, for is not Art immortal?

What we would fain see are some signs of the vitality of art in our midst, to counteract the wearing friction that tends to reduce us to a dull level of mediocrity. The

imaginative faculties which formed a Michael Angelo, a Titian, or Raffaelle, and the other masters of the great ages of art, are wanting amongst us. Conditions are changed. We seem to be all rank and file, without any leading genius. There is something in the present system of equality of education depressing to individual minds, and repressive of the imaginative faculty which we freely confess we are absolutely unable and powerless to suggest any remedy for.

The above remarks refer more particularly to black work on stone, and only in a more remote degree to preparing keystones. But chalking on stone for colour work is a very usual mode of carrying out the reproduction of pictures by chromo-lithography, and is resorted to frequently, either in conjunction with or apart from stipple, or with or without "splashing."

We may here conveniently point out that the "Air-brush" is only a more perfect form of the "splashing" process, and we think that from its fineness it will find its most legitimate employment in the preparation of colour stones. There is an inherent insipidity and flatness in everything we have yet seen attempted in the way of black and white, which we may call monochrome, but which in this case would be a misnomer, because all air-brush subjects have hitherto been printed from three or more stones to produce that which would be ordinarily attempted by the chalkist from one stone only. The charm of softness and fineness is, to our judgment, entirely counteracted and overbalanced by the flatness and poverty above alluded to. We, therefore, adhere to the opinion that, whilst we do not deny that it might be highly advantageous as an adjunct to be used here and there partially to supplement other methods, or to be used conjointly with them, especially in rendering washes of colour, it is *per se* of no practical value as a substitute for what we may term orthodox lithography, or perhaps legitimate chalking. Here it fails entirely in our humble opinion.

There can be no reason why the knowledge of the attributes of line should not be applied in the preparation of colour stones as well as in that of the key or in the production of litho monochrome, and there can be no incongruity in supplementing line work here and there with

stipple, splashing, or even "air-brush" work, any more than there is in flat-chalking or rubbing-in tints with a stump or a glove finger. A disposition is noticeable in nearly all high-class American work to make the key stone or black stone coarser and more open in the grain than the colour stones, and especial care is taken not to usurp in the black any such drawing or texture as can be more properly carried out in the colour stones afterwards. The colouring, which most frequently is entirely carried out with three or four printings, is, by this system, able to convey, without dirtiness or impurity of colour, a great deal more effect than is possible or even desirable were it all done in the key, as is too often the case in English work. A smutty key, with colours printed from coarse-grained stones, is only at best an incongruity, a sort of coloured or tinted edition of a black drawing, instead of being a reproduction of a coloured drawing where the key is simply subservient and serves only to cut out and define such details as require to be so cut out. In other words the key stone should more frequently resemble a touch stone than it does, and, if for facilitating the crossing of certain colours, it is desirable in the offsets to have here and there outlines from the key stone, to insure fidelity and perfect register, such outlines ought, once the offsets have been put down, to be all polished away, leaving to the work on the colour stones the expression of what is to be conveyed thereby.

If rubbed tints are resorted to for colour work, and the grain is thus filled up from the bottom, instead of the top of the grain only carrying the tint, texture may in many instances be obtained by chalking also with a firm hand and touch over the rubbed tint, or splashing and stippling may be resorted to, either in addition to or instead of chalking over the rubbed tint.

What is most to be guarded against is the ease with which one falls into the great fault of getting the colour stones too flat in appearance. Flat washes are here and there an absolute necessity in order faithfully to reproduce the original, but universal flatness simply by setting up a want of contrast detracts from the quality of flatness in those parts where it is essential.

In short, key stones should never be attempted by those

whose experience has been only in monochrome, any more than they should attempt to prepare colour stones, the result in either case can only be what might be anticipated. He, only, who technically understands colour work, can know just where to leave off in the key, yet it is very usual to give the key into the hands of men unaccustomed to colour work, under the impression that, since they are superior draughtsmen, the forms and expression of the original will be better carried out. It is, however, a fallacy.

## CHAPTER XVI.

Etching upon Copperplate—Grounds—Re-biting grounds—Upon Steel—Limited power of Reproduction—Electrotyping Etchings—Transferring to Stone—Etching by means of the Battery.

THE deservedly valued process or art of etching has been for two or three centuries a favourite pastime with our greatest painters, with professional engravers, and also with amateurs. Vandyck, Rubens, Raffaelle, and others have left behind them rare proofs of their etchings, and no age has since failed to contribute its quota. The method employed is very simple. Any one who can draw at all can perform the first part of the work; the second part, the biting-in, is not so easy, and requires some study, judgment, and experience, but it may be acquired in time.

The copperplate, polished with charcoal and oil and fine-powdered emery, known as "crocus," is first heated sufficiently to melt wax, and is then coated by being rubbed gently whilst warm with white wax folded in fine muslin. It is then allowed to cool, and is next blackened by being smoked in the flame of a candle or lamp. A tracing of the subject is then made on gelatine or talc sheet with a needle point, and after being charged with Indian-red, or vermilion, it is reversed on to the etching ground, where the red outline remains adhering to the wax. An etching needle, *i.e.*, a sharp needle point fixed in a suitable holder, is then taken, and with it the outline is very carefully scraped through the etching ground to the copper itself; the stronger parts of the outline may, with some advantage, actually cut into the face of the copper here and there. When the outline has been completed, the shading may be proceeded with until the whole of the drawing has been finished. On examination, this will, of

necessity, be found of one uniform thickness of line, that of the needle point; it depends upon the etching afterwards to thicken such lines as require it, and to leave others fine and firm.

To perform the etching, first build a wall of wax all round the drawing on the plate, leaving a lip or spout at one corner by which to pour off the acid at a moment's notice. Have ready a large jug of pure water, a pair of bellows, and a wooden pail. Take a weak solution of nitric acid and water and pour it over the plate evenly, watch very carefully with an eyeglass until your finest lines are bitten deep enough. Then pour off the acid into the bottle again and cover the plate with water only, two or three times, to remove all trace of acid, and dry the plate with the bellows. When thoroughly dry, stop out with a camel-hair pencil and "Brunswick black" (varnish) all such portions as are deep enough, and, as soon as the varnish is set, pour on the acid and water again, increasing its strength a little from time to time, and repeating the operation as often as necessary until the full depth of the darkest lines is attained. Then, warm and wipe off the wax with a soft rag and turpentine till the plate is perfectly clean; by filling the lines with fine lamp-black the drawing will be distinctly visible.

To take a rough proof of the plate, soap a piece of hard paper all over, and whilst the soap is damp rub it down on the face of the plate with a burnisher; the loose lamp-black lying in the lines will adhere to the damp soap, and, if carefully lifted, will give you an idea of what the effect is. If any portion of the plate requires to be retouched, heat it and coat it with a "re-biting ground," and then proceed to work with the etching needle as before upon the part to be retouched, "biting-in" as previously explained. Should the "biting-in" be carried on too far, here and there, it may be made lighter by burnishing the copper down and then polishing it with charcoal and oil; or, if very deep, the plate can be bumped up from the back with a hammer, the part being laid face down upon a small steel-faced anvil to receive the blow; it must afterwards be burnished and polished with crocus and charcoal and oil. It should, however, be stated that every care must be taken to avoid having to resort to such expedients, as

thereby one of the characteristic beauties of the etching is entirely destroyed, namely, what is termed the "burr." Connoisseurs will not buy even a fine copy of an etching after this "burr" is worn off in the printing, as they consider that its pristine beauty has departed. This burr consists in a certain indescribable roughness on the edges of the lines, and if the plate be partially repolished this roughness isworn down and disappears, and its characteristic freshness is gone.

The appearance of an etching is very often much enhanced by cutting such lines as may be made bolder, deeper, and broader, with a graver, which also burrs up the copper slightly. But amateurs need not be surprised to find this cutting up very difficult at first, the graver being a tool that requires regular training to use properly, and, until a little previous practice has given one full command of it, the graver may slip and spoil the whole plate, especially if it be not extremely sharp. Nor should an amateur think of attempting to acquire the use of the graver without the instruction of an engraver, as the manner of holding it is quite unlike the holding of any other tool, and if once the wrong way be acquired it is doubly difficult afterwards to learn the right way of holding it. Further, the hold of the graver for wood-engraving is distinctly different from that for copperplate. In the former the ball of the thumb is used as the guide, whilst the fleshy part of the first joint (beside the nail) of the first finger is substituted in the latter, the point of that finger bearing on the surface of the plate.

Many amateurs content themselves with merely making the drawings on the plate, and paying a professional engraver to bite them in and prove them, afterwards marking the proof and sending it back for the engraver to retouch. By this means a better result is almost certain; but the merit is really divided, and only the credit of the easier half of the result belongs to the etcher. Surely it would be more satisfactory to expend the money paid for etching in taking lessons which would place the etcher in a position to do it all himself and to be independent of extraneous aid, whilst he could honourably accept the whole of the credit for the work.

In what is designated commercial work the flat washes of the drawing to be reproduced are expressed by means of ruling,—that is, a series of equidistant lines ruled by machine in the etching ground, and afterwards bitten-in with the rest of the work. This is done for cheapness; but, unless it be very artistically and carefully stopped out and vignetted in the biting-in, it scarcely ever looks well. The extra labour and thought involved in producing the hand work will, therefore, be amply rewarded by the artistic feeling exhibited in the result.

Steel being many degrees harder than copper, and being capable of being bitten in with acid in precisely the same way, is employed as the medium for the engraver where extra fineness or a much larger number of impressions is required. It is, however, rarely used by etchers, as it may be truly said of it that the hardness of the metal stamps its own character on the work, and it looks hard and dry and devoid of richness, just as zinco blocks look when they are compared with wood blocks. It must, indeed, be the firm wrist, and bold, fearless individuality of a master that can impress the ideality of artistic feeling upon the hard, cold, unsympathetic steel. It is curious to follow out similar theorems of the fitness of the varied mediums whereon men impress their imaginative ideas in the form of art work. The same result may always be noted, that the most plastic and pliant and softest give off the nearest to perfect reproductions; but some lose their first beauty, while those mediums which are hardest and most enduring cannot render the soft emotional poetry of artistic conception, but they will yield many more impressions without deteriorating from the first standard of excellence. We might almost deduce a parallel axiom to the famous saying in mechanics, that "what you lose in power you gain in speed, and *vice versâ*." What is lost in impressionableness is made up in reproductiveness.

There are two drawbacks to the etching process, and these are the want of permanency in the plate itself, and the impossibility of obtaining anything approaching good transfers to stone for long numbers. A transfer of an etching is, in fact, from the absence of burr, not at all like the plate; no amount of care and skill can obviate this, it

ends always in failure. The flatness and insipidity of a worn plate is only reproduced with these defects intensified, the smoothness of all plate transfers when put to stone being much more visible, in the case of etchings, than when taken from ordinary copperplate engravings. Even if photo-lithography be resorted to, the thin poverty of ink on the copies will utterly destroy the richness and depth of colour, which are the chief attributes and beauties of the etchings.

Whilst these drawbacks, however, prevent the possibility of printing long numbers from any etching, they also cut the other way, by enhancing the price of each of the very limited number of copies. Connoisseurs prefer to buy at a higher figure because they know that such copies will never be common, but will become rarer and rarer, like old china, and thus possess a fictitious value in contradistinction to an intrinsic one. This tendency to high prices has led to the production of very clever imitations of rare etchings. Fac-similes have been carefully prepared and printed upon paper as like the original as possible, aged by being steeped in coffee and then smoked in a chimney until a sufficient appearance of antiquity is obtained. But these forgeries rarely deceive any one who has studied etching or practised it himself. There is always a suspicious look about them to a real connoisseur, who examines them with the aid of a strong glass; he can detect the difference of age in the ink itself, the brownness of the faded original never being perfectly imitated by making a similar colour with new inks.

By far the most successful method of obtaining reproductions of etchings is to take electrotype copies of the plate itself before the printing from the original is attempted. These electro plates will each give off nearly as many copies as the original, with a very slight deterioration of the burr; but great care is required in safeguarding the burr, as deposited copper, being purer, is, of course, softer than the copperplate on which the original has been etched. Supposing 100,000 copies be required for a widely-circulating illustrated journal or magazine, 200 electrotypes would each give 500 sufficiently good copies to insure perfect justice being done to every purchaser, and the original etching, not having been used, could, in the event of a further demand, be again electrotyped.

It may be pointed out to etchers that a saving of time may be effected, and more delicate etching accomplished, by means of a battery, than by the older method of pouring acid upon the plate itself. In the latter process, air-bubbles are being constantly formed wherever the acid is biting—*i.e.*, wherever the acid is chemically uniting with the metal to form nitrate of copper; the oxygen, liberated in escaping from the water with which the nitric acid is associated, forms bubbles of liberated hydrogen, which the etcher has frequently to dispel with a fine camel-hair pencil or he cannot see with certainty to what depth the acid has gone. These bubbles also, to some extent, unless so removed, prevent the acid from attacking the metal; but in a battery, the moment contact is severed, the process ceases, and the plate may be withdrawn and examined, and even laid away without any disastrous result. Nor is it necessary to build any wall of wax around to form a dish for the acid. Of course, it will be understood that the plate must be hung on the zinc pole of the battery opposite the copper pole, and, if simultaneously the other, or copper pole, be utilised in electrotyping, no waste of metal will take place, for the copper taken from one pole will deposit upon the other.

## CHAPTER XVII.

Mezzotint—Modus Operandi—Difficulty of Printing—Theory—Beauty of Effect—Composite-plate application to Photo-engraving—Argument in favour of performing primarily the Mechanical Process and afterwards the Chemical Mezzotint, the fittest vehicle for Photo-engraving—Photo Colour-blindness.

MEZZOTINTO engraving, as its name implies, is a means of giving the effect of a "soft" or "middle tint" or tone to the print. Line does not enter into this branch at all, the effect being produced by exceedingly fine dots running into one another to an equal depth so as to give the appearance of Indian-ink washes upon a toothed drawing-paper. A polished plate of steel or copper is taken, and, with a peculiar-shaped tool called, technically, a "rocking" tool, the surface is covered in every direction with fine conical holes produced by the series of points cut on the radial surface of the tool. An impression of the plate pulled at copperplate press will then show a very dark even wash, almost black. This groundwork, with its concomitant foothold (as we might term it) for the ink, is destined to form the darkest or blackest shades in the finished work. The high lights are produced by means of a scraper, which may be made of a small saw-file with all the cuts ground down smooth and rubbed flat upon an oil-stone, so as to convert the three corners into cutting edges, and curved to form a sharp triangular point. With this scraper the "mezzotint ground," as it is termed, is gradually cut away until a hollow deeper than the ground is made in the plate. In the printing this smooth-surfaced hollow affords no foothold for the ink, all of which must be wiped out, thus producing simply pure white. For all the intermediate shades the scraper is again requisitioned, but its use is not carried

so far. As the numberless holes forming the "ground" are all tapered as they go to their final depth, their widest dimensions being at the surface of the plate, each one is narrowed wherever the scraper removes the top or surface layer. If layer after layer be removed, the holes become narrower and narrower still, until in the printing less and less ink can be retained, the superfluity being wiped away. This produces, of course, comparatively lighter and lighter tints, and yet, from the extreme fineness of the dots, the effect of soft washes of different grades is never lost. This is the broad principle of working, but softening off the edges of the different depths requires the aid of the graver, the burnisher, the charcoal and the crocus rubber, all of which demand experience in their use; whilst great judgment is required in the process of scraping, which must not be carried too far. It is true that, if one loses colour in any part, acid (diluted) may be used with a point of a camel-hair pencil, which will, to some extent, reinstate it; and, it is also true that proofs can be taken as guides at any and every stage of the progress of the plate, thus reducing the ultimate result to an almost absolute certainty. But there is apt to be a sacrifice of an appearance of spontaneity in the work, which will too often assume a look of having been laboured and of being rather too mechanical. It is the highest art, we are told, to conceal art, and in all the slower arts of reproduction the extreme difficulty is effectually to hide the long, tedious labour, and make it seem that the result has been easily attained in a semi-careless, slap-dash, rapid manner, at once masterly and effective. All the originality of treatment in the original sketch can be reproduced, but it will only be by patient, conscientious toil, and this must not appear evident; the result should render the original exactly with all its spontaneity.

Perhaps the most cogent reason why Mezzotint is not nowadays so frequently chosen as a mode of reproduction may be found in the fact that it is extremely difficult to print, and it is very rarely that one can meet with copper-plate printers who have had any experience. This is because the white parts of the plate are, as we have shown, the deepest; hence the superfluity of ink has to be wiped

out from below the surface instead of off the surface itself, as in the ordinary copperplate. It will thus be seen that very great care and long practice are required, and not only this, but a hard, horny hand will never succeed, it requires a soft hand to reach into the hollows and take up the ink. Under the most favourable circumstances, the time necessary to perform the inking and the wiping out of the plate must be very much more than in ordinary copperplate printing, while there will of necessity be considerably more spoiled copies, and from the rarity of printers the prices paid must be proportionately higher. These considerations, therefore, preclude, to a great degree, the wider employment of what is one of the must beautiful of the reproductive arts.

Whether it is possible to obviate the difficulty inherent in printing mezzotint plates by substituting plates in which the light parts are higher than the darks, and which could, consequently, be more easily wiped clean with the hand and whiting, we have not been able from actual experiment to determine. Mezzotint appears of all processes the best adapted to reproduce photographs, if it could in any way be utilised; and, if the mechanical portion of the work could be completed before, instead of after, the chemical process, actinic engraving might be considered to have been attained. As a theory merely, for the benefit of those interested, we offer the following:—

Suppose a mezzotint ground to be given to a steel plate and afterwards coated with deposited copper to a thickness equal to the depth of the punctures of the "rocking-tool," and then its surface planed level and polished, we should have a surface which could only print *white* (*i.e.*, which would not print at all) on the top, and below that surface another, viz., the mezzotint ground, capable, wherever the copper was removed, of printing *black*. Now, as the copper deposited on the steel would be in layers, following the depressions or punctures in the steel like geological strata, forming hills and valleys in miniature, until the surface was planed level, obeying the laws observed in reversing the process in the battery, we should expect to find the copper come away in strata just as it was first deposited. To put it otherwise, the laminæ, or thin plates of copper,

would line the holes in the steel plate and build them up as long as the deposit was continued, until it would fill them up; the tops of the miniature hills would be raised in proportion, and, being afterwards planed off level, the centre point of each valley would, we should expect, be first attacked, then the next layer, and so on. If this really turns out to be the case, the rest would be simple. Instead of scraping away the steel, as in mezzotint, to form a sunk light or white part, all such pure whites should be stopped out with varnish, to prevent the copper being acted on in the etching. The next lightest tints could then be etched slightly, and afterwards stopped out, and the next shades etched still deeper, and so on, until in the deepest blacks the steel would be reached and entirely denuded of copper.

By means of some one of the many processes for producing photographic pictures impervious in the whites to acid, such as bitumen acted on by bichromate of potash, a plate might be etched in the battery without the aid of stopping out at all; and a reproduction of the photograph, in which all the mechanical part of the process had been completed before the chemical process commenced, would be the result.

There can be no doubt as to black and white being capable of attainment by the use of such a composite plate; the only doubt is about the half-tone. If the copper were eaten off in the same layers in which it was originally deposited, half-tone would be produced by a series of points or holes, each the centre of what was previously a valley in the steel, such holes being taper. As each layer or stratum of copper was removed, the holes would become larger, as is the case in mezzotint (except that the process of scraping is the inverse of etching), and would thus give a deeper tint, and so on, until the steel, *i.e.*, the solid black, was reached. We should then have a plate as easy to "wipe out" as an ordinary copperplate engraving. It will be seen, therefore, that the whole thing depends upon whether, after the copperplate had been planed and polished, the copper would obey the law, as expected, and come off strata after strata in the same planes in which it was deposited, or whether, on the other hand, the battery

would act upon it in layers parallel to the levelled and polished surface artificially produced, in which case no half-tone could be possible, and the theory would fall to pieces. A very simple experiment would decide the matter at once, and to those who have the leisure and inclination to try it, we would say, Get a piece of steel, upon which have a "half-ground" rocked; deposit the copper upon it and file it down flat; a piece one single inch square would prove as much as a large plate could do. Having polished the copper, subject it to the battery on the zinc pole, and after a few minutes examine it with a strong glass. If the centres of the valleys go into fine holes, the experiment succeeds; if not, it fails.

Judging by the results of the improved methods of transferring to stone, we might reasonably infer that, were this composite plate successful, this would be the most practical process for transferring to stone. That is to say, that, with the amount of ink and the general sharpness of the stipple of the mezzotint, the result ought to approach more closely to the effect of the original than any other plate process of transferring for machine printing.

If this were the case, mezzotint would no longer be handicapped by extreme cost of printing, and would become much more widely used and much more highly appreciated. It would also extend by supplying the requisite stipple for photographic engraving, to enable the stone to hold and retain the ink in the half-tones. This has hitherto had to be artificially supplied by various means, such as fine network, touching up with the graver, granulated surfaces and many other expedients, none of which can really be said to have been eminently successful. Nor is the reason far to seek; the mechanical part of these processes is commenced after the more delicate chemical process is completed, which, in the very nature of things, is illogical. It stands to reason that the human hand and the human eye cannot succeed in producing shades of photographic minuteness, or, if it were possible, why attempt photo-engraving at all? But, if all the mechanical work were completed as in the photograph itself, previous to commencing the chemical processes, some hope might be rationally entertained of achieving a success. We do not

polish the glass for a photographic negative after the photograph is taken, we complete the mechanical process of manufacturing and polishing first, and then commence the photographic process. But in all photo-engraving this is illogically reversed, hence want of success.

Mezzotint, before even the advent of the now obsolete daguerreotype (the first practical form of photography), gave to the world the nearest and best expression of soft washes capable of being printed, and therefore has a claim to be the fittest medium for reproducing the soft washes of the photograph. Science, even now, suggests means of obviating the effects of the colour-blindness of photography, as we may call the curious divergence of actinic and prismatic rays in their action in passing through the lens and affecting the chemical constituents of the sensitive plate. A thoroughly good and reliable photo-engraving process would naturally bring forth at once all sorts of further attempts to produce photographs in which less and less of this colour-blindness would be apparent. It is only the impetus which would thus be applied that is wanting to stimulate the votaries of pure scientific photography to attempt this problem, which, until it is solved, mars everything all round.

There could be no greater triumph of science combined with art than this, that without the knowledge of the artist-engraver, who translates colour into black and white, a photograph should be produced, with the full balance of nature's light and shade, unmarred by any incongruity due to misrepresentation of nature's colouring, and a plate or stone so prepared as to insure thousands of identical copies being printed in permanent carbon ink. Notwithstanding that we thus dispense in this with the skilled translative power of the engraver and appear to contradict what we have said before, it will be seen that this is only an apparent contradiction. We have not too many men capable of the work under consideration; their knowledge could be readily applied with a far greater advantage to the community in higher walks of art, where their imaginative faculties, guided by this very knowledge, would produce a nobler harvest than in any mere translation, however grand such traduct might be. So that, viewed as a question of

political economy, we could spare one class of artist for higher and better uses, whilst at the same time we perform such work by the aid of science more accurately and in less time, without debarring art at all from her best share of the work, that of the creative and imaginative faculties of the artist,—without debarring art, because science as the hand-maiden of art would be employed in reproducing the creations of imaginative artists, and these following the inevitable would, by education of the public taste, be more and more highly appreciated the more the masses became capable of appreciating the power and force of the artist's individual mind. It would be the simple instrument in disseminating widely, for the benefit mutually of the artist and the masses, the flights of fancy and the aspirations of his trained imagination after intrinsic beauty; whilst the artistic drudgery, so to term it, of the translation into monochrome would be relegated to science—an all-round gain.

## CHAPTER XVIII.

Engraving on Copperplate and on Steel in Line—"Historical" Engraving, Portraiture—Translation from Colour to Black and White—Disuse of Engraving—Improved Methods of Transferring Line Engraving.

PROBABLY the highest phase of reproductive art is that of the engraver, *par excellence*, who commits with infinite pains and labour his translation of a great master's painting into "black and white," to the permanent plate from which are printed the copies, which we call steel engravings of pictures. Firstly, of course, the drawing (or "motif" as the French call it) in black and white must be carefully finished, as it would be beyond human skill to attempt simultaneously the rendering in black and white as well as the "line" which has to represent so much, and in most cases the size of the original precludes its being engraved so large, which necessitates a proportionate and symmetrical reduction. Hence the engraver must be an *artist* as well as an engraver, for every varying shade of colour must find some expression of its precise value as compared relatively with all other such shades in the original.

The engraver must not only be capable of fully appreciating the delicacy of the faintest changes of light and shade and colour, and of reproducing, as it were, in another language the feeling and sentiment of the author, but every item of his weight of colouring, from heavy reds to the lightest and most aërial blues and yellows, like zephyrs—every tone where atmosphere subdues the purity by the most delicate and almost imponderable greys—must be duly marked and rendered. And, beyond all this, the general balance of the effect of the original must not be disturbed. In substituting a shade of Indian ink for a purple or a red,

what discrimination is required to maintain the equilibrium of the original under the new dress!

If the painter be alive, the black and white when finished is submitted to him for approval, and suggestions and consultations take place. When all is decided, the engraver commences by making an exceedingly careful tracing, the whole of the "drawing," that is, the *form* throughout, being scrupulously given.

This tracing is then put down upon the etching ground on the plate itself and etched with an etching needle, every line and every minute touch being most carefully and conscientiously drawn in and compared with the drawing from the picture. When this has been completed the next process is to "bite it up" with acid, and then to remove the ground and clean the plate. At this stage it is usual to pull a few proofs for comparison with the copy, and also so as to be able to try the effect on the proof of any particular "line" before engraving it upon the plate, when any doubt exists in the engraver's mind. Any corrections that, after careful examination, are found necessary are then made with the dry point or the graver. The main business of adding the line itself then begins. This is done slowly and deliberately by hand with the graver, line after line being cut with the help of a magnifying-glass. The art permits of the exercise of any amount of thought and study, and if by accident any slip or error of judgment occurs it may be scraped out and the part re-done. We have known the graver work on such a plate to occupy nearly two years of highly-skilled labour. Any parts of the picture which are required to be very fine and very perfect in line, such as sky and water, are first ruled in by machine on an etching ground and "bitten up" with acid to the required strength, when any gradation of tone is added by re-entering such lines where required by hand with the graver.

This curt and rapid description can only convey a very faint conception of the art of engraving on plate; the profession alone can form an adequate idea of the thought, judgment, and labour bestowed in reproducing satisfactorily the artist's picture. Proof after proof "in progress" is taken and compared, this part softened, that made darker, these lines strengthened, those burnished down finer, here

and there retouching with the graver, anon a little cross-hatching introduced, in short, every conceivable resource employed to perfect and complete the work. Then the subscribers' "proofs before letters" are printed, which is a guarantee that only very few copies are printed at the higher price, the first proofs being the most valuable, the plate imperceptibly deteriorating with the wear of printing. The plate is then "lettered," that is, the title of the subject, the dedication, and the publisher's name are added, and the limited number of copies are struck off, when the plate is defaced by cutting up deep lines across it, to prevent any future use of it, or it is sometimes entirely destroyed. The publisher frequently has a proof exhibited with the marks of destruction upon it, to show to subscribers that he has kept faith with them, and not allowed copies to become so common as to detract from the value of the edition. Plates so defaced have frequently fallen into the hands of Jews, who have sent them abroad and had the defacing marks "bumped up" from the back, and then the parts re-cut as near like the original as they could by some inferior engraver. They have then had more copies printed off surreptitiously, and passed them off as original copies, in some cases going so far as to obliterate the "letters," and print imitation "artist's proofs before letters" upon india paper. Such fraudulent prints are to be met with occasionally at mock auctions and sale-rooms; they are of no value, and are too easily recognised by connoisseurs as worn-plate copies, to deceive any but those who are "not in the know." Examined with a glass, the edges of the lines appear rounded instead of sharp and incisive, the finer lines especially look broken and rugged, whilst all the artistic beauty it originally possessed is gone entirely; it is, in fact, a mere semblance of itself.

As we have said elsewhere, the demand for high-class steel engraving is on the wane. Photo reproductions of pictures and photographic copies of paintings have seriously affected the market. This is a matter of profound regret, as photography, however good in its way, cannot pretend to reproduce in monochrome the colouring of a picture; yellows of the purest delicacy come nearly, or quite, as strong as vivid reds; dark blue has no actinic value, and

a white void takes its place in the photograph or photogravure. Any shade produceable by admixture of these colours is influenced in the same way, and therefore the original picture is misrepresented; at most the form only is given, and even here, owing to the treatment in painting, true form itself is lost in these worthless so-called reproductions. Apart from the decadence of the "historical" engraver's profession itself, the loss of an element in the education of the public taste in art is greatly to be deplored.

Another substitute, not nearly so objectionable as the photograph in the reproduction of good pictures, is the chromo, which, instead of translating colour into black and white, attempts to convey the colour itself. Whilst regretting the absence of the power of line, we must admit the value, in forming public taste, of thus popularising colour, which is not only beneficial from an artistic point of view, but, as a sanitary and hygienic factor, really tends, by its healthy action on the nerves of the eye, to assist in maintaining sounder physical functions, especially in cities, where the eye, deprived of the great expanses of blue in the sky and green in the fields and woods, craves some substitute without being conscious of what is really wanting.

Portraiture rendered in line engraving has been, perhaps, more widely superseded than any other branch of the art by photography on the one hand and by lithography on the other, mainly on account of costliness. As a matter of actual excellence, no comparison can exist between a line engraving from a painting and a photo or a chalk portrait on stone; as a matter of cheapness and expediency, it may be defensible. It is, however, one more sign of the mediocrity of the times in which we live, that we can hardly hope to see worthy successors to such men as Thomas Landseer, Samuel Cousens, or Stothard, whose profession may be said not to have outlived them.

If this, unhappily, be the case, and the art of the historical engraver is to become obsolete, it is the more important that the research and thought of generations of artists, who have found ample scope in this particular phase of art, shall not be allowed to die without fruition in some shape or other. Like the phœnix, this art knowledge must rise from its ashes, and live again in some other

purposeful form. In the improvement and perfection of processes for obtaining more exquisite transfers to stone from plate, so that something approaching to satisfactory copies of line engraving shall be possible by machine printing, is to be found the only probable rescue of engraving from the catalogue of lost and disused arts.

## CHAPTER XIX.

Theory of Colour — Complementaries — Colour Printing — Colour-blindness — Iritis: its Causes and its Cure — Pigments—Their Chemical Properties—The Effect of Materials in Contact with them—Result to British Trade of Neglecting Technical Education of those engaged in Colour Printing.

EVERY ray of light that travels from the sun is divisible into three imponderable portions—viz., heat, light, and the actinic force. We need not here consider rays of heat at all, as it is chiefly with light that we now have to deal, and the white rays of light that we observe everywhere around us are simply the cause of all colour, which is not positive, but is merely an effect.

We term an object blue or red, but it is not really so; it is simply endowed with the power of absorbing one portion of the white ray of light and reflecting back the rest. Accordingly, as certain parts of the ray are so absorbed, leaving certain other parts to travel to the eye, we term such bodies red or blue or yellow. Every white ray, then, is sub-divisible into further portions by means of what is termed polarization. By means of a prism three primary and four secondary coloured rays may be thrown upon a white screen, the image thus thrown being called the spectrum. The three primary rays are the red, the blue, and the yellow; the secondaries are violet, which is produced by blending red and blue; green, a blending of blue and yellow; orange, a blend of red and yellow; and grey, a combination of them all. If a disc be divided into three parts, one of which is coloured blue, another red, and another yellow, and is made to revolve very rapidly, the eye cannot detect any colour at all, the disc looks quite white, which proves that if the exact proportions of red, blue and yellow which compose the white ray be observed the result is *white*.

If, instead of using a prism, we take any body that has

the power of absorbing all the red rays and reflecting the rest of the white ray, it ceases to look white and becomes green. If both red and blue are absorbed, it becomes yellow. Therefore, the complementary rays that have to be added to red to form white are blue and yellow, which together form green, *i.e.*, red is the complementary of green, and green of red. Orange is the complementary of blue, and blue of orange. Yellow is the complementary of violet, and *vice versâ*.

Infinite variety of colour is producible by varying the proportions of each component part. Thus, any mixture of red and blue is violet, but according as red or blue preponderate the hue changes, and becomes colder or warmer; and again if yellow be added by degrees to violet, a new series of hues are produced, which are, properly speaking, greys, whence we deduce that whenever we mix complementary colours in any proportion whatsoever the result is grey. Since colour can only be produced in this way by mixing red, blue, and yellow in different degrees, we ought theoretically to be able with these three only to paint a picture throughout, and as each colour demands one printing only, we ought to be able to produce every shade, tint, and hue with three printings. In practice, however, we find that this is not possible, because the attributes of pigments are more or less imperfect. These bodies do not absorb perfectly all the red or blue or other rays, and do not perfectly reflect all that remain after this imperfect absorption. Hence we have a variety of different reds and blues, &c, such as vermilion and rose reds, azure and Prussian and indigo blues, and we cannot substitute one for another without completely changing the effect, not only as regards the colour itself and those it is mixed with, but, as will presently be seen, those colours and tints which are merely in juxtaposition to the one which has been substituted.

It is a curious fact that if supplementary colours are placed next each other, both of them appear brighter and purer than if they were placed next to one of their component colours. Green never looks so pure, for instance, when placed next to blue or yellow, of which it is composed, as it does next red, which is its complementary.

In colour printing, there are two modifying means of reproducing shades or varieties of colour, viz., extenuation and super-position. Extenuation is the operation of using light tints instead of solid colour. Super-position is printing one tint or colour over another previously printed, so as to influence and modify it.

In reproducing colour-work, therefore, due consideration is requisite in deciding which of these two means, or whether both together, shall be employed; and another consideration also forces itself on the attention, namely, the sequence in which the different printings shall be executed. If a pale blue be printed over a flesh the effect will not be the same as if the blue were printed first. This necessitates the upper tint being paler than if it were to be the under-printing. Having decided upon the sequence, and how far the broadest masses of colour in the original shall be produced by extenuation, and how far one may depend upon super-position, the question arises of the quality of such points of colour as are incapable of being printed by the same printing, such as varieties of blue or of red. For instance, suppose a lake and a vermilion occur; one must weigh well the chances of being able to modify the lake sufficiently with yellow to produce the vermilion tint. It is quite true that an immense resource is left to the chromo artist in the greys, usually the last printings, which may be said, like charity, to cover a multitude of sins. Having before him the proofs of the job in progress, any incongruities can very easily be toned down by passing over them light tints of grey—but the less that is left over for rectification the better. The plan of asking for more printings when the seventh or eighth is reached, and it is found that opportunities have been lost, is not by any means a good precedent, but this is better than spoiling the job by attempting too much in the last grey. There is also the resource of altering the tones from those of the proof when the job comes to be printed, so as to correct any incongruities and to insure more harmonious colouring; as, for instance, where a stone has been worked too strong, printing it in paler ink.

The French adopt the following method of making offsets for colour-work, which, we think, will be worth

mentioning here; they are cleaner and sharper than the old method. Instead of using ink and then dusting Venetian red, or other powder colour, upon the impression before putting it down upon the stone destined for use as a colour-stone, mix crimson lake with honey, and with a clean roller (not a varnished-colour roller, but a calf-skin black roller thoroughly free from ink) roll up the job with the mixture, getting it thoroughly charged. No time should be lost in lifting out the key and setting the press for the stone for the offset, unless it is convenient to use a second press, which is a better plan. The stone is then moistened thoroughly with alum and water or turpentine (the first is preferable), and the proof in honey and colour is laid down in its proper position and pulled. The offset will, immediately it is dry, be found sharp and clear and the stone clean for working upon. If it is intended to "stipple" the job, of course, a polished stone is used, if for chalk, a grained stone. We are told that the "Litho-plate" may have offsets, in honey, put down exactly in the same manner as stone itself without any risk, which opens up facilities for a more extensive use of the plates for colour-work, as they are not capable of being chemically affected by coloured inks, no matter what their ingredients; nor can they affect the colours injuriously any more than if printing from stone were substituted.

Reverting again to the theory of colour being non-existent in reality, and the effect being produced by the properties which bodies have of absorption of certain rays and of refraction of others, we find the explanation of colour-blindness as it is called.

It is really only by a stretch of the imagination that ordinary people can realise the terrible deprivation the phenomenon of colour blindness presents. All the vast range of delightful sensation which colour can bestow cut off, and rendered to the nerves of the eye only as if in monochrome, opens up a sad picture indeed—only one degree removed from the saddest of all afflictions, absolute blindness. A deaf man gains almost as much as he loses by not hearing everything, a man devoid of the sense of smell escapes at any rate all the bad odours, if he loses the

perfumes; but the colour-blind lose half the subtle influences that act upon the imagination of man.

It is true that they cannot miss what they have never known, for colour-blindness never comes on;—it is the absence of the power of distinguishing colours from one another, inherent in the nervous structure of the eye from birth. But those who can feast their eyes upon the loveliness of nature's changeful colouring cannot but feel pity for the colour-blind.

Take an historical instance, Sir Humphrey Davy, the great chemist, the philosophic discoverer of the atomic theory. When testing one solution by the addition of other known ingredients, Sir Humphrey, knowing beforehand from books that a change of colour engendered by this addition ought to take place, could not by reason of his being devoid of the power of discriminating between one colour and another, decide upon his own result. He was absolutely at the mercy of others, and had to ask what name could be applied to the colour of the solution under consideration. Imagine the misery to an artist, if it were only possible to be struck colour-blind! This is fortunately impossible, but still there lurks a common danger to those who follow the reproductive arts of lithography and of engraving. There is a peculiar disease known to the faculty as a form of Iritis, which is an affection of the nerves of that portion of the eye known as the pupil or "iris." God has, in His all-wise beneficence, ordained in the construction of the eye a most wonderful arrangement that proves how graciously He has provided for all His creatures' wants. In the healthy and not over-worked eye, passage from bright light to dark instantaneously produces, by means of a set of very sensitive nerves, a corresponding dilation of the pupil, at once admitting to the retina the full complement of rays of the remaining light.

Upon suddenly entering a brightly-lighted room from the dark the iris easily and naturally contracts proportionately, till its diameter prevents too much light acting upon the delicate series of nerves forming the retina, which would give positive pain, and if repeated cause inflammation. Let us suppose a long-continued course of systematic overtime, performed in vitiated air (which aggravates all purely

nervous disorders), and by bright and concentrated artificial light. What is the consequence? The nerves which command the contraction and dilation of the pupil become sluggish in their action, and then the victim finds that on entering a dark room, such as his sleeping chamber, he cannot see at all for a period varying from a few minutes to perhaps one or two hours, according to the progress made by the disease. On leaving a dark chamber and coming into strong sunlight, the pupil cannot contract with commensurate rapidity, and consequently the retina is suddenly flooded with the surplus light which a healthy eye would stop out at once, and the patient cannot see anything but a burning excess of light, similar to looking straight at the noonday sun. This state of things ends in one of two ways; either the retina becomes so inflamed by the constant recurrence of the irritation at each change from room to room, and each variation of the degrees of light, that the sight is permanently injured, or the nerves of the pupil become chronically morbid and entirely cease to act; that is to say, either the sight goes absolutely, or it is temporarily eclipsed by the pupils ceasing to act. We once heard a very shrewd remark from an American on the subject of the electric light. "If I had a son," said he, "I would bring him up to be an oculist, for if electric lighting is to go on, that is certain to be the best business on earth." Electric lighting has this effect upon the eye, it enervates the nerves that Providence has entrusted with the function of shutting out all surplus light from the delicate retina. The writer was told by one of the largest jobmasters in Paris, that those of his horses which were employed at night, plying round the Place de l'Opera, and other parts of the city lighted by electric lamps, went blind in a few months. Investigation would show that the pupil nerves would be the first affected, because these nerves have been designed with the all-wise purpose of protecting the more delicate retina-nerves; and as these are of coarser texture, the result might be warded off if precautions were taken in time. Anyone suffering from any affection of the eye may lay down these rules. Firstly, abstain from working by an artificial light, which your eyes were never ordained for; secondly, pure cold water frequently applied

is the safest nerve-tonic possible. Dip the face in water and open the eyes under water, several times a day. It cannot be said that this is an expensive or even an inconvenient application, and it is very effectual. In extreme cases it is necessary to keep in a dark room until the normal condition of the nerves of the pupil is restored, but if on the first symptoms of impaired vision recourse is at once had to cold water bathing of the eyes, this cessation of business may be avoided.

It has been also noticed that constantly receiving red rays only on the retina is extremely injurious, and those who are printing red constantly or frequently can guard against this by surrounding themselves, as much as possible, with the complementary colour of red, viz., *green*. Were proof needed that any complementary colour has the power of neutralising the effect of its supplementary, the following experiment will demonstrate it. Provide a pair of spectacles, one glass of which should be red, the other clear white glass. Then, with green letters printed on a black ground placed before you, close the eye to which the clear glass is applied, and try to read with the other eye through the red medium. You will see no trace whatever of any letters, all will appear to be black only. It is held by some that we only learn the names of certain colours, and recollect to what substances we apply them, and that like "up," "down," and other relative terms, they have no real existence. But this must be a fallacy; for, as we have seen, an inanimate and, therefore, an unimaginative prism invariably decomposes the white ray of light into the same spectral divisions, and invariably in the same proportion and the same sequence relatively; hence rays of these colours do exist, and our names for them are not at all relative, but absolute. The pigments we distinguish by the names of colours, although, in reality, colourless in themselves, have the quality of reflecting back rays of that colour, and absorbing the remainder, *i.e.*, the complementary rays, which amounts to the same thing, as though they were possessed of colour themselves.

Pigments, however, have, besides their refractive and absorbent attributes, chemical qualities, which are of paramount importance to the colour-printer. Every coloured

pigment has a chemical composition, and when in contact with other chemically-composed pigments, it is possible that the affinity of one of the component parts of one for another component part of some other pigment may set up decomposition, with the result that both colours are destroyed, or, more correctly speaking, the power of absorbing certain portions of the white rays of light, and refracting other portions, may be so vitiated by one part combining chemically with another as to spoil both. Chemistry infallibly teaches us what results to anticipate when two or more bodies are brought into contact; it measures their affinities, and predicts with certainty their behaviour under certain known laws and conditions. The colour-printer and the colour-mixer must, therefore, apply to Chemistry for her aid in all he does. As an instance, it is well known that vermilion, which is a preparation of mercury, is turned black by contact with copper, therefore electrotypes intended for printing in red should be, and usually are, afterwards plated with nickel or brass, the former being the better. Iron itself has a very perceptible effect on the aniline colours, and also upon varnish and gum. In mixing, say aniline red, or magenta lake, as it is sometimes called, with a steel palette-knife and gum arabic, the colour sets, or coagulates, and curdles on the slab, and especially if the gum be sourish. This is due to the knife becoming to a slight extent oxidised, and this oxide mixing with the gum and colour renders them partially insoluble. Hence we deduce that all iron or steel articles coming in contact with colours, whether water colours or printing inks, should be nickel-plated. The inking slabs of litho machines are usually of marble, but what is the use of that if the ink trough and roller, and ductor-plate are iron or steel, or if the printer stirs up the ink with a steel palette-knife? In letterpress machines the inking tables are rarely anything but iron, or sometimes wood, which we prefer to either metal or marble, because in any temperature wood, being a bad conductor of heat, is never too cold nor too warm for the ink, but the duct roller and plate should be nickel-plated for colour work.

It will be seen, therefore, that there is a wide field for

pleasurable study for all engaged in colour-printing, not only in the direction of becoming conversant with the effects capable of being produced by juxtaposition and super-position of pigments, and being able to select those best adapted to produce any required result, but more especially in acquiring a scientific store of knowledge of the chemical composition of the pigments used, so as to foretell their behaviour when in contact with one another and with materials likely to affect them. The former consists in educating the eye and the perceptive faculty phrenologically known as the organ of *colour*, that portion of the brain whence the nerves of the retina which are entrusted with the transit to the brain of those sensations denoting colour are centred; for it is there that in some inscrutable manner the wonderful conversion of sensations into ideas is performed. The latter can, of course, be acquired by chemical studies. Can any one doubt the necessity for what is known as technical education, so long as such vast fields of scientific research remain almost unexplored, with all their hidden improvements waiting discovery? But still we go on grumbling that competition is so keen, growling about the "British workman," he in his turn complaining about the British employer, urging that he is expected to turn out good work with bad materials and bad tools; whilst Germany and America are forging ahead, with the settled purpose of driving the British out of every market, as England once did with the Dutch, neither of them neglecting so much as a straw that might be useful to their plans. Is this to be allowed to be accomplished without a final effort before it is too late? Are we going to give in, apathetically, without a struggle, without a thought as to the future of our vastly-increasing population? or shall we in thorough earnest learn technically our business? With regard to technical instruction in printing, engraving, and lithography, we must in passing point out that, if it be confined to those who either are now or intend to be following these professions as a mode of livelihood, nothing can be wiser than this means of supplementing what the day's work itself teaches practically, by technical theorising at night. But if, on the other hand, such knowledge is to be imparted to others

not following these professions, we cannot see any useful purpose in so doing, but a positive harm both to employers and employed. Every employer is quite aware of the difficulty of pleasing customers who know a little of the business and fancy they know a great deal—they are always captious, and find fault in order to show off their own supposed knowledge. And every *employé* knows that in his own particular branch semi-practical outsiders, who do not yet know enough to be conscious how little they really know, are constantly coming into the trade, and by their incompetence lower the standard of average excellence, and thereby lower the standard of wages. Intrinsically such instruction is a boon if limited to its own proper sphere of usefulness, but if abused or extended beyond its due limits, it is capable of producing downright mischief.

## CHAPTER XX.

Management of Paper, &c., for Printing upon—Hot-pressing before and after Printing—Varnishing and Gelatining Tickets for Goods—Hints to Ticket Buyers—Gummed Papers.

THE printer's principal difficulty in dealing with paper of different kinds is that due to its expansion and contraction under variations of the state of the atmosphere, irrespective of quality or of the material of which it is manufactured. Any change of the weather, and very often merely a change in the direction of the wind, will have an effect upon paper which may be exposed to its action. In printing a single colour, of course it is of comparatively small moment whether a part of the impression has been worked upon paper which has shrunk or stretched to some degree, the difference would not be noticed; but careful precaution is necessary to prevent expansion or contraction during the many stages involved in printing colour after colour in perfect register upon the same sheets. In lithography particularly, when ten to fifteen different printings are by no means rare, such precautions are more a necessity than in letterpress, especially as another cause of stretching is developed. The pressure of the cylinder upon the paper as it lies upon the stone is naturally much greater than that required for letterpress work. The stone, unlike the form, is in contact all over its surface with the pressure cylinder, while at the same time it is moist and damp except where it is inked. This introduces two more elements, beyond the influence of the weather, into the calculation. The pressure constantly acting time after time on each sheet as colour after colour is laid on must have a tendency

to roll out and stretch the paper lengthwise of the stroke, and this is further assisted by the dampness of the stone.

To counteract this the paper required for jobs containing several printings should be rolled at the mills several times between sheets of zinc so as to stretch it to the full extent of which it is capable before commencing to print the first colour. The impressions pulled for the offsets for the colour stones should be upon the actual paper upon which the job is to be worked, technically termed "its own," so that if any stretch is left in the paper the offset may be also stretched larger to compensate for it. If it be found when the key comes to be printed, that it is too small to fit the job, the difficulty may generally be overcome by putting down a transfer of it and stretching it in the same direction in the hand-press while it is being transferred. Where many colours are used, however, it is seldom the key is printed at all, it serves only for the offsets, and a touch-stone made up from it is substituted and takes its place in the printing. Above and beyond these precautions there remains the self-evident one of keeping up the same atmospheric conditions all through the job. The temperature should be kept equable and sufficiently high to dry out the moisture soaked up by each sheet before it has again to pass through the machine; whilst currents of air which one day may be dry and the next charged with moisture should be absolutely excluded.

What is true of paper, *i.e.*, of single sheets, is more noticeably so, as regards cardboards. These consist of several layers of paper, often of very inferior quality, inside, faced with a better paper for the printing surface, which, in the case of enamelled boards, is again subjected to change by being coated with size and white or other body colour. Unless very well rolled, boards of this description will be sure to stretch a great deal more in proportion than any sheet of single paper. From having soft or pulpy middles they are more absorbant of moisture, and therefore require more than ordinary care in maintaining them exactly at one degree of dryness.

Another difficulty, more especially in the larger sizes of paper, is caused by the reams being as a rule sent in

"folded" instead of "flat," for convenience of carriage. The paper-makers should always be advised, when paper is intended for colour-work, so send it in *flat*, whether it be for litho or letterpress. Unless folded paper be damped, dried, and again rolled, the folds can never be got rid of, and vexation and loss of time must result.

Again, as is the case with other commodities which are sold by weight, the paper manufacturer (to put the matter in its mildest form) takes care that it shall not *lose* weight from extreme dryness whilst in stock. Its power of absorption renders this remarkably easy, and in these days of ruinous competition it is not unknown as a means of re-adjusting prices. Of course, we shall be told that any maker allowing paper to be too damp would run the risk of having it all spoiled by mildew. But are there not resources in chemistry for the prevention of such consequences? We know of, at least, two re-agents that will act in this direction, but for obvious reasons we shall not disclose them for the benefit of those who might, by an extreme chance, not be aware of their existence.

In papers where preventatives of mildew have been used certain colours are chemically affected by their presence, especially where Käolin (China clay) has been also requisitioned as a weight-giver. China clay is, chemically, the silicate of alumina, and manifests itself in the fine white powder which frequently covers the machine where such paper is being printed. The printer may thus readily detect an adulteration that injures his types, spoils his ink and colours, or wears the job off the stone. This adds one more item of evidence to prove that it is, in the long run, cheaper to buy a good article than to try to buy below the price at which it ceases to pay to make such article honestly.

Another point that should be noticed here is, that in colour-printing sufficient time should be allowed to elapse between the printings to permit one colour to be thoroughly dry before the next is laid on. Otherwise it will not lift, or if it does lift the next colour, and is not thoroughly dry, the latter will set off on the back of the next sheet and in some cases cause it to stick to it, which involves loss of time in separating them and the risk of torn and

spoiled sheets. This is also frequently due to adulterated paper, which does not absorb the colour or the vehicle sufficiently. Sometimes it is due to the adulteration of varnish with rosin, which is cheaper than linseed oil, but which is productive of evils costing more to remedy than the extra price which would have to be paid for pure unadulterated varnish.

We may here allude to another drawback, though of slighter consequence, with respect to paper as it is delivered, namely, the varying size. Sheets, even in the same ream, often measure a quarter and three-eights of an inch more than others, and it is very rare to find sheets, especially large sizes, square at their edges. This will cause the inconvenience that in laying the sheets to the side-set, after the grippers have got hold of the sheet, the edge, if not square, will push itself in a crease from the side-set. If this is found to be the case, either have the paper trimmed perfectly square with the gripper edge, or turn the paper round so that the edge next the side-set shall be less than a right angle, instead of more than a right angle, when, instead of creasing by reason of the sheet encroaching on the side-set, it will, as it is drawn through, recede from it, and thus obviate the difficulty. Nevertheless, any loss that might result from the paper-maker delivering paper out of square could legally be recovered from him, and therefore more care ought to be exercised in this matter by the trade. To ascertain whether or not any given sheet of paper is square, fold it down upon its narrowest diagonal, *i.e.*, from one corner to the other side of the sheet, then fold down the other side edge to one corner of the part already folded down, keeping the edge of the folded part exactly to the edge of the part underneath, and press down both folds with a paper knife. If the two edges touch along their whole length, the sheet is square; if not, it is out of square. Another plan, more accurate, perhaps, is to draw two diagonals, that is, two lines exactly from corner to corner, and measure them very carefully and minutely. If square, they will be exactly of equal length; if not, the paper is not square.

We may at this stage, in conjunction with this subject, allude to the finish of printed work, either by hot-pressing or rolling, which gives to American work that smooth surface and rich gloss that our own work so rarely attempts. There are several machines for obtaining this finish, but from some cause or another, our firms do not avail themselves of the unquestionable advantage to anything like a general extent. The best work is improved in appearance, inferior work rendered passable, and all not only enhanced in appearance, but made much more durable in so far as it is less liable to become soiled by this process of rolling between heated rollers. For letterpress it is needless to urge that it takes out all embossing and thoroughly dries the ink, reducing any spotty lumps and glossing over, does for the colour what a fine coat of varnish does in painting. The same machine is also available for giving blank paper extra rolling before printing is commenced so as to ensure its being thoroughly stretched ; and especially this is the case when enamelled papers, cardboards or enamelled boards, which have not been ordered expressly, are intended to be utilised. If the cost or trouble involved in this finish were of such magnitude as to seriously affect an estimate, we could readily understand the apparent neglect of the trade. But, as it is not an expensive or troublesome process, and as it is a positive aid in the despatch of delivery—actually enabling work that, otherwise, would not be dry enough for packing to be instantly rendered fit for delivery—we can only look upon this disregard as a fatuity. Prints from chalk drawings on grained stones, however, should never be rolled, as it produces unpleasant flatness.

There has been a great outcry about foreign competition. In the really excellent design exhibited in the line of what is usually termed "tickets for goods" we are being distanced by the Germans and Belgians, who either varnish or "gelatine" their work, as also their showcards. For work that is intended to be afterwards subjected to either of these processes, nothing at all likely to facilitate and cheapen such processes can for a moment be compared with hot-pressing first. Half the gloss depends upon the smoothing of the surface on which it is laid. In

what is termed "French polishing" furniture, any roughness of finish makes it utterly impossible to obtain a gloss, and the reason is self-evident. Smoothness refracts and reflects light, and inequalities only alter the angle of reflection and break up the effect.

To those, therefore, who complain of foreign competition, we would urge that in this as in every other business of life, we must first seek to produce the very best work, neglecting no means known to us of perfecting every detail, and having done so seek to reduce cost of production (in legitimate directions only), and trust to the discrimination of buyers to support the best looking article, even if they have to pay a little more for it.

It has been constantly urged by consumers of "tickets for goods" that these are not articles which are re-sold at a profit, but are really partaking of the nature of a necessary, but at the same time an objectionable tax, deducted from profit upon the goods, and therefore they seek the very cheapest. Yet it could easily be shown that in proportion to the attractiveness of such tickets and their power of arresting attention so the sale of the goods is increased. And it may be justly argued that, if one is obliged to pay out of profits a certain sum per annum for tickets, it is anything but false economy to pay a little extra for better effect and more attractive labels. "Good goods," like good wine, "need no bush," but nowadays two things are needful, firstly, that "good goods" should be known widely, and secondly, that in the event of an appreciative customer requiring a second and a third supply, he should have some idea imprinted upon his mind, a sort of system of involuntary mnemonics, that would enable him to identify the article readily when he sees it again, such as a trade-mark or ticket, and for which, when purchasing, he could easily inquire.

Such are the primary conditions of one of the largest branches of chromatic printing, and every little point which may be the means of turning the scale in favour of the home manufacturer of such articles as tickets for goods is well worthy of attention and consideration.

Tickets for goods are very frequently printed upon gummed papers to avoid delay in putting them upon the

piece of goods, while other firms prefer to print upon plain paper ungummed and afterwards gum them. If it be done first, the rolling referred to above gives a better finish, and obviates the "cockling" likely to take place in gumming afterwards; but if the latter plan be adopted, certainly before the sheets are cut up into separate tickets, they should be hot-pressed to give them finish, and take out any "cockling" produced by gumming.

## CHAPTER XXI.

American Lithography — Advantageous conditions there — Vastness of field—Protection—True economy of buying best material—and testing new improvements.

THERE is one very noticeable characteristic of the American business programme which strikes an Englishman, who happens to travel in the States, very forcibly, and that is that tradesmen are doggedly resolved to do one of two things, either to produce a somewhat inferior article in immense quantities at a price hitherto unheard of, or to produce, regardless of cost, some article superior of its kind to all other similar ones. The writer was some years ago much impressed, on a visit to America, with this tendency to extremes ; and quite lately, on meeting English travellers recently returned from the States, these views have received remarkable confirmation, more especially as regards Lithography. No one seems content with mediocre aims in business. It must be big, either the best work possible, regardless of expense, or an immense output of inferior stuff at the lowest price ; but of the two, the best class has by far the greatest number of votaries.

No doubt Germany, which of course was the fatherland of lithography, has contributed to the young country a "bent" in this direction, by constant emigration of Germans to America ; but this graft, so to speak, has been productive, just as it was in a minor degree in Scotland, in producing some of the best disciples of the art. The American litho houses are not afraid to pay high prices for artistic design, and to their permanent staff of litho artists, head printers and managers, and they exact great care and

painstaking from their workmen all round. They are not niggardly in wages, materials, and paper, nor do they seek to make an illegitimate profit by hurrying the work through for cheapness' sake. The conditions of America, be it observed, differ from those of all other countries insomuch as they warrant a very rich harvest from their lavish expenditure. Advertising in every conceivable way is an absolute necessity of business in the States, and the enormous spaces at the command of advertisers in the various towns encourage what amounts almost to a mania for big advertisements, which can be easily displayed there, but which would be impossible here. We could not find spaces large enough in England to display half the advertising posters which are there pasted up, even on the faces of the great rocks of the Alleghanies! Hence American lithographic firms book orders for tens of thousands of copies for huge bills to cover a continent, whilst English houses can never hope for more than enough to cover our railway stations and a few hoardings in the larger towns. Similarly, just as we are thus limited to size and short numbers, so is Paris limited again, in comparison with us. It is but rarely one sees on the walls of Paris posters larger than "double colombier" (125 c. by 85 c., or in English inches, $49 \times 34\frac{1}{4}$), which are, moreover, subject to a stamp duty of $2\frac{1}{2}$d. for each sheet, payable before the poster is allowed to be displayed; nor, we may say in passing, is it lawful to use *white* paper in France and black type, as this is reserved for Government Proclamations, unless a certain proportion of the white paper is covered down either by staining, which is often done, or by printing coloured grounds over a large portion of it.

Fostered, then, by an almost unlimited demand for large posters in fine colours, American lithographic firms vie with each other in obtaining the best possible talent, and never "spoil the ship for a halfpennyworth of tar," the heavy duty, of about 20 per cent. *ad valorem*, on imported printing, keeping out all competition from this side. No doubt, they are thus enabled to obtain very much better prices, and, from the number of their bills annually brought over here, more especially by American theatrical companies, minstrels, or showmen, which in quality surpass similar styles of

work executed here, there can be but little doubt that a great deal more might be done by us in this line if a better quality of work were produced. American firms have actually commenced to compete with English houses in theatrical work for use in England, and in manufacturers' show-cards of a superior class; and, whilst the production of their style of work must inevitably be more costly, still the work itself, it must be confessed, is irreproachable.

It is in attention to minute details, and getting all these perfect, that this excellence is attained; it is because there is none of that "make-it-do" spirit about these firms, but, on the contrary, a desire is everywhere manifest to turn out the best work at any cost. There is no hurry or bustle, good work must have its time; in short, each process is gone through as though everything depended solely upon that one point, hence excellence is attained all round. It cannot surely, for one moment, be admitted that English houses *cannot* turn out work equally well; but the fact remains that, with but few exceptions, they *do* not. The sole cause of this, we believe, is to be found in the facts above stated. Orders in America are given on a much larger scale, and Protection shuts out foreign competition; hence better prices obtain, and there is no necessity to resort to such expedients as using cheaper paper, cheaper inks, and rushing the work through, to lessen the cost of production,—evils that exist with us to an unlimited extent.

Turning to letterpress work, no one can fail to notice that there is a certain finish about much American work which we do not say is unattained here, but which, at all events, is far from being the rule. The Americans have produced far more high-class printing than we have, and it pays them as well as work of a lower standard, whilst it cannot be said to do so here. Mediocrity seems to be our national characteristic at present in many things. Those who can excel in any particular branch find out that better remuneration is offered in America, and they go; the rank and file, however, are better paid here, as they are not in any demand there, and they remain. It would be idle to speculate as to a remedy for this state of things, but the facts are worth study and attention.

One drawback to better prices being obtained for chromo

or colour printing is the fact, that very low rates of wages obtain in Germany and Belgium, and foreign competition under our system of Free Trade, allows this to interfere with prices of work done here to an unexpected extent, reducing wages and compelling English houses to use the cheapest materials of which they can get hold, causing deterioration of standard of work and its concomitant evils. There can be no doubt that, whilst the balance of good resulting from Free Trade in this country far exceeds the evil to which it has given rise, Protection seems to answer at present in America, and one result is, as we have shown, the raising of the standard of excellence in workmanship of almost every kind. It should, however, be borne in mind that the purchasing power of wages is greater in England than in America; and we may safely assume that a week's wages here is more, proportionately to a man's necessary expenditure, than a week's wages over there.

These remarks, in order to be of any practical utility, must be pursued further, and we will endeavour to demonstrate that good work does not, after all, cost much more than bad or "jerry" work; it is a question only of good management. Let us just follow a job throughout, say, a litho colour job in chalk; and let us suppose that the sketch is a good practical one, by a designer who knows what he is about, and has adapted it, say, to six printings. Unhappily, let us remark, in passing, it too frequently happens that men who, although they can design, draw, and colour well, fancy that they also are fully competent to undertake to design for Lithography, when, in reality, they have not the slightest idea as to the technical modes by which each tone of colour has to be subsequently rendered by the litho-artist. A good litho artist, it must be at once granted, can reproduce any shade or tone of colour, but at what expense? He must have more printings allowed in order to be able to produce exactly the effect of the original. If this original were the work of a designer possessing sufficient technical knowledge of the after-processes, all needless colouring might be avoided; and it is scarcely too much to say that such broad treatment of the subject would prove a positive gain. Whilst the colourist who knows nothing of technicalities is only groping his way, the one who is practical,

seeing clearly in his mind's eye the method his successor on the job will have to follow, can render the subject so as to make it easy with fewer printings, and at the same time, with the knowledge which begets power, and with a definite aim before him which governs every touch, he obtains a better effect, to say nothing of the certainty that it can be carried out conscientiously in the reproduction.

Now, in picking out the six stones for the job, price is too often studied in an abstract way, without reference to other economical considerations. Second and third-rate stones, with veins and chalk-pits in them, cost much less than those without flaws, and are too often bought in order to keep down expense; but there is one important factor omitted in such calculations, viz., the extra time which the artist must spend in concealing the flaws and imperfections inherent in the stone itself. Nor does it end here, the printer's time is wasted in also attempting to keep such parts of the job open as occur on the unequal degrees of texture in faulty stones. Better pay more in the first instance; it is real economy in the long run.

Again, suppose the stones are ground, it is false economy not to allow the necessary time to get them perfectly true. If the stone-grinder spends two hours in doing so, he will save more in machine-minders' wages (which, be it remembered, are above double the rate of his pay) than he would save by letting them remain slightly out of the level. Nor is there real gain in graining the stones from the grinding, instead of first polishing them; yet this is too often done. A bright, sharp, clear grain on the stone means simply a reduction of the time of the artist, whose salary is perhaps four or five times at least that of the stone-polisher; and this sort of grain is simply impossible, unless the stone be polished after grinding before graining. Nor is there anything but a fictitious saving in the etching being carelessly done. It is a positive gain, after rolling up a stone, to pounce it with resin and re-etch it strongly, especially for machine-work, when it is a question of printing chalk work, to which we are now principally referring. Another apparent gain is supposed to result from hurrying work through. "Most haste" is always "worst speed." All these points are most carefully watched by the American houses we

have referred to, whose names we could give were it necessary; and we may add that *they* find it pays to use good paper and best ink. Inferior paper contains dressing that not only affects the job on the stone, but attacks the colours used, chemically; bad ink entails loss of time, does not in the long-run go as far as good ink, and, what is worse, has no permanency, fading rapidly when exposed to light, besides injuring the rollers; and this remark applies to letterpress as well as to lithography.

In English houses there is too much make-shift, too great a disposition to utilise material unfit for the purpose. We do not say that there are no houses where this is not the prevailing notion; far from it. We know hundreds of houses where true economy dictates the policy of giving every job a good chance; but the fact unhappily remains that, taking the average, the tendency is quite the reverse. This proceeds from many causes; sometimes from the possession of inadequate capital; sometimes because the manager, be he partner or paid servant, whilst he is invaluable as a business man, lacks that experience of the technicalities of the working part of the business which can only be gained by actually performing himself some one of the many processes which, intimately connected together, go to form the practical *régime* and routine of a printing-house. It is becoming more rare in these days of limited liability concerns to find united in one person the requisite capabilities of business man and practical working manager, and it is but seldom that we find concerns large enough to support adequately two men to share these responsibilities.

Another very prolific cause of this want of true economy is the disastrous effect upon prices of what we may term illicit competition—that is, readiness to undertake work at prices that cannot possibly pay, for the sake of obtaining larger contracts at a better price later on; and then, to avoid losing too much at once, the artist is told that it is "*cut low*," and he must get it out somehow as quickly as he can. The cheapest stones, the poorest paper, and the commonest ink and colours are all resorted to, to "pull the fat out of the fire." What we wish to point out is that such ideas of cheapening production are merely illusory, and never answer expectations.

Another characteristic of the American printing-houses we have referred to is the extreme readiness to test and try for themselves any alleged improvements in machinery or plant, and any new processes which may appear likely to save time or to be capable of producing better results, and they give all such a fair trial. They draw the line between cutting down expenses in a truly economical way, and the means resorted to, as we have shown above, in cheeseparing and false economy. Everyone who can discover means of performing work as well as, or better than, now done, and in a quicker way, or of saving labour and time by means of better tools or machinery, is working in the right direction, and really benefits the Trade thereby. It is an exploded theory that machinery supersedes hand labour and reduces the number of those employed. The fact is, it cheapens production so much that it increases, in a much greater ratio, the demand. If quality deteriorates to some extent and is sacrificed, and the result is not so durable, the demand is, in consequence, not filled up for so long a period, and, by recurring more frequently, finds a wider field of employment for labour.

We would, therefore, urge upon each and all concerned in business connected with the Lithographic Trades to look to their laurels; earnestly to examine the system upon which their several businesses are conducted; to decide whether they will be parties to illicit competition, and the suicidal policy of ruining prices and forcing themselves and others to the plan of turning out inferior work and using inferior materials; or whether, like true Englishmen, they will resolve that they will never lower their flag, but maintain the English name for good workmanship and honest dealing.

It may be urged that it is no use for an individual house to attempt to stem the tide that everyone is being carried against his will by the current; but it can also be said with equal truth that every individual deciding in favour of the right counts two on a division, and, besides, has right on his side. Cannot, we would ask, an Association of Employers be formed to correct existing abuses? Looming in the immediate future is the fact that under the advantage which Protection temporarily confers on the Trade in

America, fostering, as it undoubtedly does, the output of high-class work, calling away from here the best talent to a seemingly higher remuneration, and creating, from the fact that it pays exceedingly well, new firms, which are springing up every day, we shall find the Americans in this, as in other business, actually competing with us in the home market, even if, as we more than suspect, they have not already done so.

It has been remarked that the sword has been a danger to England, and that she has not succumbed. The pen, which includes the Press (*i.e.*, printing), is far more likely to prove the arena of future danger to her Commerce than any war that could be declared against her; and we call upon one and all to do their level best, each in his own sphere of the Printing Trades, in order to secure a more prosperous future.

## CHAPTER XXII.

The Ink-duct, the Printer's "Colour-box"—A Two-colour Job—Dividing the Duct into Compartments—Choice of Colour or Shade of Colour for each—Effects obtainable—Utilising this in Chromo-litho Work—Application to Artistic Pictorial Work from Blocks—Management of Roller-contact in parts of Transit—Bronzing by Machine.

A FEW remarks upon this topic may interest many of our readers, and while we must be understood to refer principally in what follows to letterpress only, we think lithographers may apply much of it to litho machines—especially as regards the gradation of colour from the same stone or form.

The capabilities of the modern letterpress machine, even where good colour work is done, are scarcely ever made the most of, especially the "bi-colour." Let us suppose, for instance, that a job has to be done from blocks in two printings, say two-sheet double crown (40 in. by 30 in.), to look as bright as it can be got for a wall advertisement. Let these two colours be, for example, red and blue, and the way of the bill be "portrait" way not broadside, the ground white, with letters shaded, some lines red with blue outline and shade line, others reverse of this, others red only, other lines blue only. Naturally if we have a two-colour machine it is put on that, and the point to be decided is whether red or blue shall be the "first end" of the machine, which, of course, means, shall the red be printed (where the two *cross* each other) over the blue, or *vice versâ*. This is generally solved by the engraver who has supplied the blocks, or by the designer of the bill. To these we point out the feasibility of arranging for several additonal changes of colour other than combinations of red and blue, by the plan of dividing the ink-duct into

compartments, with different colours in each, by means of lead blocks (cast in the duct itself), each colour being either kept separate by keeping the distributors straight, or blended like a *rainbow* by letting them "wave" more or less, at a greater or less angle to the sides of the machine.

The "rainbowing" gives a fine scope for variety of brilliant colouring, and may be resorted to at *both* ends of a machine, thus giving a twofold effect by superposition. For example, suppose blue to be first and red second end, with a line of lettering about six or seven inches from the top of the sheet, which would be red with a blue shadow in the ordinary mode of printing, but which we will change by making a separate compartment in the first duct (the blue) for a bright purple, and exactly opposite in the second duct (the red) a compartment for yellow. We here have a line picked out on the bill in bright yellow (or green if we choose) with a purple shadow-line if we keep the wavers straight; but, if we choose, we can run them askew and blend the red into the yellow, producing every variety of colour between the two, everything between yellow and orange, and everything between orange and red, and, at the first end, by similar means we obtain a blending of purple and blue. Then, again, we have the portions of each form which cross each other; as, for instance, if the body of the letters in the line were solid in one block, and the lower, or the upper or middle, part of them solid also in the other, another variety of colouring is at once produced, that of the blending of whatever shades are opposite one another. It is extremely difficult to describe shades of colour in language, but, broadly speaking, it is possible to arrange to have the yellow at one end passing over the blue at the other, when a bright green will result, giving quite a new effect.

What may be done for the line supposed to be selected as above, may also be done for some other or others in a totally distinct or different colouring. Nor is this all. If we can divide the ink-duct for various colours, we can also vary the tints of the same colour. By having compartments in the duct we can have four or five tints of the blue or of the red, as for example, bronze-blue-ultramarine, and their results, when mixed with white or let down with

transparent varnish; or rose, vermillion, and ruby reds, also solid or mixed with white or rendered transparent with varnish. Nothing need prevent our arranging to a nicety which tint or tone shall superimpose any other chosen tint or tone—and all this with *two* printings, *i.e.*, at one operation on a *two*-colour machine.

It may be objected that it is next to an impossibility to keep the colour pure and invariable on a two-colour machine at second end if the rollers are constantly passing over portions of the second form upon which portions of the first form have set off. We admit the difficulty, but do not consider it insuperable. Without thought, judgment, and experience, our plan is very unlikely to succeed; but with these, in the choice of suitable paper, ink of a proper consistency and quick drying properties, and watchfulness and dexterity in regulating the exact supply necessary, there ought to be *no* set-off on the second form for the second inkers to pick up and carry on to the slab and destroy the purity of the colour. If, however, the set-off cannot thus be remedied, make two workings of the job, with an interval of time between, and the result will even then be cheap at the cost! It will have the effect of *ten* or more workings at the cost of *two*.

Again, it may be objected that by giving a customer the advantage of obtaining this superiority of effect at the cost of an inferior one produced by only two colours, we should simply prevent his ever going to the expense of more printings, and thus there would be *less* trade. We answer this by asking a question. If it is possible to reduce the cost of any production by legitimate means, how much wider is the circle of others who have not the capital for speculation in the high-priced original article who would be brought within the radius of the lower priced one? There are very few millionaires in the world. If you produce an article which only they can afford, your sale will be limited to a score or two; if, on the contrary, you can produce an article that the ordinarily wealthy can afford, you may sell a hundred thousand at perhaps a smaller profit, but at a rate that will pay better. If, again, instead of courting the custom of the millionaire, you cater for the million, you are getting into a safer, a more lasting, and a better paying business.

It is on long numbers that a printer gets "*fat.*" Besides this, those who first come in the field with like improvements, take the cream and the cake, at any rate for a time, until others follow their lead.

We have in chromo-lithography frequently a printing devoted to *one spot of colour* that *seems* unattainable by other printings, which might however have been arrived at by selecting some other colour stone which was bare at that particular point, and making a separate division of the ink-duct so as to embrace the desired spot of colour in this one printing. We are of opinion that a very great saving might be effected in most chromos, if the artist only bore in mind this extra power, and was original and imaginative enough to step out of his well-worn groove now and then, and utilise to the full the means at his disposal. We hope in the not far distant future to pursue this subject futher, as there seems to us a field for ingenuity in obviating wherever possible the mere mechanical routine of using one stone for one colour and one tone only of that particular colour, instead of striking out into imaginative variety. How often, for instance, might a grey stone, instead of being the same shade throughout, be printed warmer in one part and colder in another.

Referring once more to letterpress work, we have endeavoured to show existent capablilities in "the printers' colour-box," the ink-duct, to produce variety of colour, instancing, for the sake of simplicity, lines of lettering. With how much more force and with what marvellously increased scope will our suggestions apply to pictorial colour-work from artistic blocks ? It is only a question of the arrangement and a thorough knowledge of what can be done that is wanted. A poster which everybody has seen on the walls, not only in London but in the provinces, "All who *swallow* Liquid Sunshine," &c., is an example of the writer's first experiment in this direction. Any printer who chooses to take the trouble to look into it will scarcely credit that its effect is produced by only three printings in the two top sheets and five in the two lower ones, yet such is the fact. It is cut on pine blocks, with various parts marked out for printing from a sub-divided scale of colour in the ink-duct.

Yet another power of regulating effect may here be mentioned, viz., that of modulating colour in the opposite direction to that of the duct on letterpress machines. We refer to bearing off one or more of the inkers in their transit across the form by tacking on various thicknesses of cardboard or thin leather to the runners, so as to lift them more or less as required, to give a barer supply and a lighter contact where a paler shade of colour is required, either at one or both ends of the roller. Most machine-minders do this in certain cases to some extent, but we should like to see this capability pushed to its extreme limit. We should suggest to machine-builders that a separate runner or "way" should be provided and fixed for each inking roller in all colour-machines, upon which the minder could regulate the exact amount of contact he re-required. In the poster above-mentioned this facility was to some extent utilised, but the want was much felt of extra accommodation so as to be able to actuate one, two, or three inkers separately.

Space precludes our going further into details, but we nope enough has been said to establish *primâ facie* that there is a field open for improving the power of the British workman and the British employer to compete successfully with foreign productions.

The printing trade has of late years decided almost universally in favour of the use of bronze as a decorative element in nearly every style of commercial advertisement. Innumerable attempts have been made to devise machines to execute the work of laying in and polishing the pulverised imitations of gold supplied by Nuremburg and other German factories. Scarcely a single firm of note exists, we believe, that has not stowed away amongst its lumber one or more machines which have attempted, but failed, to supersede the slow and poisonous process of performing the labour by hand. Heretofore, in fact, the praiseworthy efforts of inventors have not been crowned with the success they deserve.

It usually falls to the lot of the young to attend to the bronzing, who are thus exposed to the unhealthy influence of this most deleterious process. Those firms which have shown the most concern for the health and well-being of

their junior hands should therefore gladly welcome a practical mechanical solution of the difficulty which would combine economy with efficiency, and, at the same time, be perfectly harmless to the operator.

We must confess that, having followed the progress of bronzing-machine inventions for many years with much interest, and having seen so many failures, we were somewhat prejudiced and sceptical when called upon to form an opinion upon Mr. W. B. Silverlock's latest improved invention. After a careful and thorough testing, however, under the most stringent conditions, we are of opinion that the problem is solved by Mr. Silverlock's invention, and that, by the aid of this machine, the operation of bronzing can be much better and more easily and cheaply performed by hand, at the same time avoiding all injury to health and to the surrounding machinery, without deterioration of the work done. In examining the machine we find, first, a trough to hold a sufficient quantity of bronze for the work, and which can be replenished as required, either by hand or by an automatic apparatus lately patented. Pursuing the sheet as it comes from type or stone through the machine, we find it to be fed with bronze enough, even were it solid, to cover it with a sufficient charge. Next, we find a rubber oscillating across the machine, which, with a gentle but resilient pressure, compels an intimate contact of the bronze with the surface of the gold size, in which the sheet has been previously printed, without disturbing it. Next comes, with simply an intervening partition, a polishing roller, which also removes some of the superfluous powder which may adhere through too much dampness of the paper. The other rollers covered with a similar material are the "wipers-off" or "dusters-off," and most effectually they perform their office, scarcely anything passing the springy points of the individual hairs of these rollers, where contact is so slight as hardly to admit of the bare idea of friction. All these rollers are so constructed, under a separate patent, as perfectly and automatically to clean themselves.

It is not pretended, we are told by the inventor, that this machine is a "dusting-off" machine, but we saw sheets of cigarette paper turned out perfectly clean, and also sheets

(upon dull surface paper) very full of work, equally well ridded of every touch of bronze except where it was needed. The sheet, fed into the bronzing machine as it leaves the printing machine, is caught by new gripper arrangements, so that, as the great cylinder revolves, the sticky surface takes the dusting from underneath, and therefore all particles, unattracted by the stickiness of the varnish, fall by gravitation.

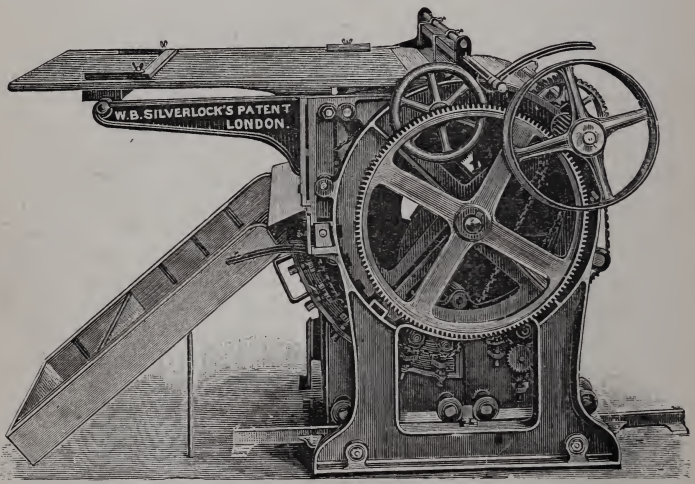
By means of "midriffs" or "midfeathers," the powdered bronze discarded by each sheet as it passes through is prevented from rising and interfering with any subsequent operation, and is thereby got rid of, so far as each sheet is concerned. The feeding with solid bronze, the polishing of all bronze that adheres, and the most perfect removal of superfluous bronze, are all perfectly provided for.

One of the prominent features of this machine is its silent action, and the entire absence of anything like dust or commotion. We stood for half an hour beside it, working at the speed of 720 revolutions per hour, without a spot upon our clothes to give evidence of bronze. We may mention that the machines being now made with two sets of grippers, two double demy sheets are bronzed at each revolution of the cylinder, so that 1,440 sheets would be bronzed in an hour. A large cylinder obtains possession of the sheets as they are fed, turns them under, passes them through the various processes, and then delivers them clean, both back and front, either face up or face down as may be desired.

We are informed that the machine is only made in two sizes, viz., dbl. demy and quad crown, occupying about one yard each way. The cylinder having two grippers, either one or the other may be disconnected at will, thus adapting the machine for very large or small sheets, or allowing two folios to be laid at same time for each gripper. Even if small sheets are sent through, no loss of bronze can be sustained, so that all the requirements of the modern printing-house can be fulfilled for one outlay.

The cylinder, slow as a tortoise, formerly made of wood, and now of polished iron, has a recent improved throwing-off motion, consisting of a series of rounded rods which tackle the back of each sheet just as the grippers release

them, and push away the sheet into a slide, thus obviating the use of tapes. As already stated, this can be so arranged as to lay them flat, either face down or face uppermost as required. The machine has all the necessary motions for properly putting on, rubbing in, polishing and dusting off, and in the simplest possible and most substantial form. The only parts liable to wear out, such as roller coverings, &c., can be readily renewed at very trifling cost. The machine is very substantial and of first-class workmanship throughout. It works smoothly, and without the noise and commotion which have always been a defect in all previous machines.




Those of our readers who may be looking out for a good machine cannot do better than examine the capabilities of this one for themselves, and we think they will be perfectly satisfied.

## CHAPTER XXIII.

Grained Paper—How it is Grained—Chalking upon Grained Paper—Transferring—Graining Transfer Tracing Paper for Colour Work and Transferring to Stone—Effects of Amateur Labour—Conclusion of the Series—New Tympan Gripper and Scraper Motion—Hints as to Cylinder Pressure Gauges.

GRAINED paper, at one time, was a good deal in vogue, and for a short period seemed almost likely to eclipse stone itself for a variety of purposes. Owing, however, to its being so easy for amateurs to work upon in their untechnical fashion, it was so much discredited that it soon fell into disuse by lithographers. Some exceedingly good specimens were done many years ago by Maclure & Macdonald, and others; some in a sketchy style, and others very finely worked up and finished; but every one seemed to drop its use for general work.

Although it is called grained paper, it is simply embossed paper, and the embossing is done either by means of a plate or from a stone, upon which the ruling or stipple-ruling has been transferred, rolled up, dusted in with bronze-powder, and strongly etched. As reliable paper is sold ready for use it could scarcely be worth while to engrave a plate and transfer it to stone, especially as there are many little points to attend to which would present difficulties to any one who had never seen the process gone through.

The grain of this paper being formed in the composition only, and not in the paper itself, it is very easily broken down; and even in tracing down great care should be used, or the point will bruise the grain and leave a white outline when transferred. The chalking is done with Lemercier's "crayon-copal," not with the ordinary litho-chalk, and the point must be kept fine, or it will close the grain up. It is

also desirable, if any high degree of finish is intended, to lay the paper on a piece of glass, and, for light tints, to raise one corner with the thumb and finger and work on the "spring of the paper," as lithographic writers do on transfer paper; by this means the gentlest contact may be maintained without any danger of bruising the grain. Any one who has been accustomed to working on stone will readily adapt himself to working on paper; it is cheaper than stone, and for small things is more quickly worked, and it has this advantage, that the drawing does not require to be reversed, as the transferring reverses it on stone. If any ink work be required, either in the way of outline or solid "brights," care should be taken that the ink is not too fluid—it should be used as thick as possible, so as not to moisten the composition too much; nor, if the ruling-pen be used, as in architectural drawing, should any more pressure be used than is absolutely necessary.

We have seen tracing-transfer grained paper used with very fair success for small portraits from photographs and for reproducing sketchy drawings, and also for small labels in colours, such as are to be carried out in two tints, or in pale red, blue, and yellow. The key is first drawn on grained paper, and the grained-tracing paper is laid down upon an impression of the key, and the colour worked upon it. With care in transferring, we have seen very good register in small work, but it is advisable to use finer grain for the colours than the key. Of course, it would not answer to pull off-sets, as the pressure would destroy the grain at once.

In transferring, the ordinary means are employed. The composition should be damped only till it becomes "tacky," and after being run through the press and damped again once or twice on the back, it may be soaked off in clean water, when the composition and the chalk will adhere to the stone and leave the paper. It should be brought up with the roller, after being left in gum till dry, and then etched, washed out, and again rolled up.

Taking this process altogether, many, if not all, its disadvantages are counter-balanced by its portability, its being put to *polished* stones, which print better by machine, and its general convenience.

Several of the most picturesque textures now introduced as Day's Shading mediums might be very readily made use of in giving to the transfer-paper the grain required for working upon with chalk. Instead of taking transfers direct from the plate, stones could be at once prepared from any of these mediums, etched deep in rosin, and thus become the matrices from which grained paper could be produced. But our own opinion upon the whole matter is, that even at the best the grained-paper process is much more likely to suit amateurs lacking in technical skill, but desirous of producing copies for their own immediate friends, than for any practical purposes of the legitimately-qualified lithographer, who, having acquired by study and practice a thorough and techical knowledge of chalk-work, will prefer stone itself, or some practical substitute, such as litho-plate, and will be willing to give up to amateurs such attempts at "Lithography made easy" as grained-paper and similar processes. Where the professional litho artist does use it, the experience and technical skill he brings to bear will effectually discourage the amateur from attempting, after a few hours' practice, to compete with one who has devoted years of study to the acquirement of his business. We think we are justified, at least to some extent, in ascribing the evils of our present low, mediocre standard of work to the ease with which amateurs and outsiders find themselves permitted to compete with professional labour.

When once public taste has become accustomed to accept inferior amateur work, the door is opened for others equally unqualified to commence a printing business which they do not understand, and to conduct it with far better chances of not actually failing than if the public taste had been educated, by a constant output of the highest class of work, to be able to detect the inferiority of the work produced. We must not be understood in thus generalising to overlook the fact that in all arts there will of necessity be men whose talents or genius tend to place them in the very front rank. But to such as these, if they could be prevented from undertaking work at a low price for the sake of practice, the very compulsion to study technicalities before they pretended to competency would re-act upon

themselves to their own personal advantage, and instead of being only worth a price lower than market value, they would, later on, command a salary higher than the market value, in proportion to their individual talents or genius. It would thus serve their own interest as well as that of professionals, and indirectly of managers and employers, if these talented ones could be compelled to serve a term as recognised improvers. At the same time, those who taught them the necessary technicalities ought to be remunerated either by way of premium or increase of salary, not only for the extra trouble, but also as an indemnity for the extra competition the mere act of teaching would bring upon themselves. Further, those who have already spent time and money, and have made sacrifices to attain a thorough technical knowledge of their art, are entitled, at least in some measure, to have the legal right of refusing to have their art overrun by apprentices and amateurs.

We are drawing to the end of our "Roundabout Papers," and will conclude with a few suggestions respecting the litho hand-press, and of some means whereby the exact amount of pressure exercised by the cylinder should be at any moment ascertainable by the printer himself, which we commend to the attention of printing machine builders and engineers as a desideratum. There are two possible improvements in the litho hand-press, which, we think, deserve notice here, the first being a much more powerful scraper arrangement, and the other a combined tympan and gripper whereby perfect register can be obtained.

In the present hand-press the scraper box hangs loose from the screw which regulates the pressure, and may be very unequal in its grip on the tympan, whilst there is no means of regulating it "fore and aft," that is to say, if the stone be thicker at one end than at the other, the pressure at the thick end will be greater than at the thin part. If the scraper-box be made with two trunnions, working in fixed journals so as to swivel, and the edge of the scraper meets the tympan at any less angle than a right angle, it is evident that the resistance will have a tendency to force it into a vertical position; and if, by a screw at the back, one can limit the angle as required at which the scraper is inclined, the "nip" or "grip" will always be attained, and

much greater pressure is obtained without extra power being required; whilst the box, being held rigid at both ends, will keep the whole pressure level throughout the stroke. The adjusting screw does not compel the scraper to remain close to its work, but simply prevents its going too far at any particular point, leaving it to find its own level up to a certain limit, according to the thickness of the stone in different parts. It is, however, the resistance of the tympan in passing under it that keeps the scraper close to its work, and as this tends always to force it into a vertical position until checked by butting on the end of the adjusting screw, pressure is always equable throughout. Many years ago we tried vulcanised india-rubber (of the very hard sort termed "ebonite" or "vulcanite") instead of boxwood for scrapers, and found they were resilient (*i.e.*, elastic in the sense that ivory balls are elastic), and did not warp or wind, keeping perfectly straight for two or three times as long as boxwood. It is more expensive at first but more durable, and can be planed up by a carpenter, and rubbed on glass paper just as well as wood. We think it gives a brighter impression, and is certainly more reliable as far as standing goes. It should, however, be clearly understood that grease affects its chemical composition, and therefore the tympan should be rubbed with soft soap when vulcanite scrapers are used.

The composite gripper-tympan is an adaptation of the gripper of the machine to the tympan of a hand-press; but the tympan frame itself requires to be made much truer and stronger, and to be fixed between adjustable pivots to a much greater nicety than in the present presses. The sides are made flat, and lie edgeways down, instead of being round. The metal or leather is fixed by a plate screwed to a bar and passes over this bar at an angle, thus giving a bevelled bed for the gripper actuated by strong springs to clip against. At the ends of the tympan side bars, opposite to the gripper, is an arrangement for tightening the leather or metal tympan. This consists of a roller with a ratchet and pawl, to which roller the tympan is screwed on a portion filed flat to receive it, and is further secured by a plate also screwed down over it to the flat on the roller. With a key fitting a square filed on the end of the roller

which projects through the sidebar, this roller may be turned until all the slack is taken up; a much quicker and more effectual means than the present screwed ends of the sidebars and the tightening-up nuts. As the tympan is raised the gripper remains closed until it arrives at the upright position, when by a lever it is opened for the withdrawal of the sheet and remains open until the spring is released by the action of lowering the tympan on to the stone. After the sheet is run through the press, by the mere action of raising the tympan, the sheet (still held by the grippers which in coming to the upright position describe an arc of a circle) is lifted from the stone and drawn gradually away from the work, thus obviating the necessity of the printer having to slide a knife under a corner to lift it from the stone. By this combined tympan and gripper, register can be quickly got and maintained throughout the job, colour after colour, as accurately as if laid to points with needles, and as rapidly as sheets can be laid to grippers and side-set on a machine. For proving jobs in colours or in short numbers, this would be found very convenient and safe. Although this has been patented, all rights have now lapsed and it has become public property, and we refer those interested for further particulars and drawings to the specification of Patent No. 1,364, dated April 5, 1879. (6d.)

We would further counsel machine makers to devise some means of registering or gauging the amount of pressure of the cyclinders of letterpress and litho-printing machines, so that printers and machine-minders might not be working entirely in the dark as at present. Good blocks and new type may be ruined by being run through the machine, even once, with excessive pressure, whilst, with enough and only just enough to give a perfect impression, blocks and type would hardly be injured at all, whilst in litho machines the breaking of stones would be frequently avoided. By the introduction of a pressure gauge, instead of guessing pressure as now, and too frequently erring in using far more than is actually necessary, practice would enable the machine-minder to know beforehand what pressure was required, and he could then regulate it accordingly. Every ounce of needless pressure, though it may seem a

matter of small moment, means extra work for the engine: that is, extra consumption of fuel or gas, and extra wear and tear of machinery, and, in the case of letterpress work, extra wear and tear of type and blocks; and all this waste produces no better result. In the litho hand-press pressure is, to some extent, gauged by the resistance offered in pulling the table through; and in the letterpress by the lever being too much to pull over; but, in the machine, the minder, unless he pulls the cylinder over by hand instead of power, has no means of knowing what pressure he has put on. We urge machine makers to take this point into consideration.

## CHAPTER XXIV.

Sound Estimating—Estimate Forms—Work-tickets—Filing Work-tickets—Illustration showing Reduced Copy of Form, available, with modifications, as Estimate Form—Cost Book unnecessary if Work-tickets are posted up—Three Typical Examples explained in detail—Advantages of the System—Wages Tickets—Diaries—Order Numbers equivalent to lengthened description.

IN any text-book on printing, unless some consideration of the system of keeping correct accounts be included, its most important feature would be omitted.

The secret of making any printing business profitable lies in the power of estimating beforehand the cost of any job that may be offered for tender—in the experience and knowledge of all the minute operations which the details of each job require, and of even the smallest of the varied processes through which it must pass in its progress through the works. Let any single item be forgotten, or its cost under-estimated, if no actual loss results, it is palpable that the profit will be reduced, if not entirely absorbed, by the mistake. If, from any cause, the probable cost be taken at too high a rate, and this be increased by the addition of the usual percentages, the result will be that the tender will be beaten by some more accurate estimate.

Between these two extremes, accuracy will be worth a little extra trouble, and every precaution that would tend to avoid omission or over-estimating, should be taken with extreme care.

The most usual way is to set up a Tabular Estimate Form, which should include every conceivable operation in the printing trade, and either print loose sheets, or bind them up in the form of an Estimate Book. It is evident that having all the possible items printed, will guard against omissions; whilst, whenever the estimating clerk has any

doubts as to the value of an operation, before filling in the price, the foreman of the department can be referred to for probable cost. This form might easily be adapted from the illustration given on page 177, of the Work-ticket.

There is no business under the sun where greater variation of detail exists than in printing. Not only does each job vary in every possible way from all others, but the taste of the customer—his peculiar individual ideas of his own requirements, oft-times dictated by his experience in his business, which, of course, could not be explained to the printer—necessitate the most careful attention to every minute particular of the instructions; and if any doubt should occur as to the carrying out of these apparently trivial minutiæ, questions should be put to elucidate the exact requirements of the customer, to avoid having the whole job thrown on the hands of the printer, possibly for what can scarcely be held to be his fault, but which, through a misunderstanding, is invariably his loss. It is scarcely too much to say that, with the exception of "repeat" orders, one never gets two jobs exactly alike in every particular in a whole lifetime. Add to this the hurry in which customers always are to get an immediate estimate, which is unreasonable in nine cases out of ten, since long experience shows that after obtaining estimates they often delay giving the order for a week or two, and then want the complete delivery in a space of time utterly insufficient to allow of really good work. But if the estimate is hurried through, the chances are that some item will be forgotten, or the price of paper, ink, or other raw material will be guessed at, instead of obtained from quotations that are binding; and thus the profits are curtailed by finding out, too late, that it cannot be bought at the figure named. The Estimate Form guards against any item being forgotten; it should be further arranged that the items put down for materials should have the name of the merchant supplying them, and his quotation on the same line; when this is not done, the blame can easily be put on the right shoulders. The main thing is to have a line for each possible charge, and to fill in conscientiously fair prices for them, regardless entirely of the total, and bearing in mind the fact that if the tender, carefully found to be

accurate, be too high to obtain the order, that it is a *gain* to lose the order, since if obtained at a lower figure, it must result in dead loss. When the total cost is arrived at beyond all possibility of error, the amount for wear and tear of plant and machinery and working expenses added on its proper line at a fixed percentage, profit should be added also at a fixed percentage, according to the rules of the house; and in certain cases this might be modified, but should be the only item to be reduced under any circumstances whatever. Considerations of policy might induce a firm to prefer even five per cent. profit to the loss of an order that might open up a new account, retain an old one, or keep a certain number of hands employed, who must otherwise be discharged; but it should invariably be made a rule that the profit only should be altered, and not the items of cost, which would only be fictitious then, and not real, and simply deceive one into making a loss. Alas! how often is this resorted to, instead of facing facts boldly, and accepting a gain of a certain small percentage, pretending that the cost will be less than experience shows it will really be, and that the profits will be handsome. How many people, eager for orders, do this foolish estimating, and go in for self-deception!

In passing, it may be pointed out that a corrected revise should be sent out in every case; and until this is signed and returned by the "client," the job should remain in abeyance. I see no reason why we should not retain this word in the French sense of customer, and even adopt the expressive collective "clientèle," which we only half translate by our word "connection," already overladen with too many meanings. Should there be any mistake discovered afterwards, such signed final revise relieves the printer of all responsibility, even if earlier instructions should happen to have been disregarded. In France this final signed revise is called a "*Bon-à-tirer*" ("good for running off"); without it nothing is ever printed. To a certain extent, the strictness of the "Code Napoleon," and its subsequent alterations, upon printers, has something, no doubt, to do with the universal exaction of a signed authority; but it is also conducive to business security in that upon it one can sue for payment if necessary, and there can be no defence

set up. It is also a security to the customer, more especially in colour work, for if the copies afterwards delivered to him be inferior to the signed proof, he can decline to receive any of them. If the printer declines to produce the signed proof, it is open to Counsel to say that he dare not.

In all estimated jobs, there should be reference in the Order Book to the folio of the estimate, as also in the Ledger, whilst the Work-ticket, now to be explained, and from which the Ledger charges ought to be made out, should be checked by the estimate, and remarks in red ink made on the latter by the manager. The order number corresponds with that of the Work-ticket, and becomes the reference to every letter, note, or message in relation to the work, so that the exact history of every job can be traced in an instant. French printers have what is termed a "dossier," or folio-back of thick brown or blue paper, often made of paper wrappers cut to size, with the order number and date outside, containing inside the Work-ticket and every proof and other document relating to the job, all kept together for instant reference.

We now come to the Work-ticket, previously alluded to (see end of volume). It consists, preferably, of a foolscap folio sheet, printed like the model page here given, which is for a general full-scope printing office. For other offices, letterpress or lithographic, where one branch only is carried on, the other items may be omitted which are not necessary. The first point is that they be consecutively numbered in series, commencing with order number (A, B, etc.) 00,001, 2, 3, etc., to correspond with the order number in the order book, which thus becomes also an index. The date, name of client, address to whom and where to be delivered, dates promised for proof and for completion, and such particulars, are entered in the heading. Below the heading line we have, between thick rules, the various departments through which the job must pass. In the example supposed, it is 5,000 posters from wood blocks, 80″ × 69″, that we have taken as model; and a reduction of the same in colours for litho bills, 30″ × 20″; and for a label, also litho, for packets, 5″ × 7½″; or an equivalent order for 5,000 large theatrical posters, eight-sheets double-crown, 1,000 double-crown

window lithos, and 100,000 "dodgers," or handbills crown 8vo. There are supposed to be four workings for each sheet—*i.e.*, black and three colours. The illustration is reduced to half-size each way, and is left blank for the reader to fill up to suit either of the supposed three cases or others he prefers as experiment. To assist this, a duplicate copy is inset, so that it can be taken out without injury to the book itself.

Having filled in the heading in accordance with above particulars for the poster, a second ticket for the double crown, and a third for the handbill, the tickets are sent to the Artists' department, and the sketching, designing, or whatever be required, is done and submitted, and the time at per hour, with the artist's name, is entered on the ticket, which is sent with the design to the Office. "No work will paid for unless recorded on a Work-ticket," enforces the time spent being entered up.

On the return of the sketch approved of (or to be altered), it is sent again with the ticket to the Artists, where all further work of this department is done to it, and it is passed, always with the ticket, to the next department. Nothing, however, is entered in the money columns until the job is completed, and it reaches the Office. In the first ticket, the sketch has been supposed to be drawn on four quad-crown boards, and these are sent to the engraver to be cut to form the key, or black. The Engraver enters his time, the value, at cost, of the boards or blocks supplied by him to the artist, opposite the line "other material," say at 6s. 6d. each. This, however, in present case would be sixteen, as there are black and three colours for each sheet, and "sixteen at 6s. 6d." would be charged. The blocks and the ticket would next go to the letter-press department for the offsets for colours, with the other twelve prepared blocks on which they are to be put down. Another advantage of the Work-ticket must be mentioned here. It shows the printer that the manager has ordered the work to be done by a certain date, and that he must do his part in order that the engraver may have the colour blocks, which are printed first, done in time, thus saving all friction and discussion. He therefore pulls the offsets, and puts them down to wood, returning

the ticket, with his time thereon, to the engraver, and name and rate of wages (if overtime, preceded in rate column by the prefix O.T.). In order to get the paper for pulls, he must go, ticket in hand, to the storekeeper, who, seeing the authority, gives out sufficient, entering on the ticket the number of reams necessary for the job, and the ink required, which he proceeds to get out of stock, to be ready when wanted, the few sheets being taken from one of the reams. Here again the ticket is a wonderful check on the waste, misuse, or pilfering of paper, saving time, unnecessary orders or requisitions, and keeping a record that must come ultimately under the manager's eye. If the engraver is not an artist, the offsets go back to the artist, who draws the colours on the top of the offsets, and enters his time once more. If the engraver is capable of doing this, his time goes down with the cutting, and he then delivers the yellow, or first colour, to the letterpress, often to be machined at once, whilst he completes the other colour blocks, thus expediting the work. With the last block he surrenders the ticket, and takes up some other job. As soon as a properly "made-ready" sheet is pulled, the minder takes it to the artist or the engraver to sign it if correct, and should never be allowed to run on without such signed copy, which relieves him of all responsibility. As completed by the fourth printing, every colour having been passed before working off, each ream is delivered to the Warehouse, and with the last ream the ticket, with a perfect copy of each sheet, folded and pinned thereto, is surrendered to the warehouseman, who collates, counts, makes-up, and packs them, entering the time expended, and obtaining from stores wrappers, cord, etc., or packing-cases, as per instructions, and getting the proper cost entered on the ticket, which now goes back to the Office, with every item entered upon it during its progress. The clerks now carry out in the first money column the amounts of each item, and into the second money column the total expenditure incurred in each separate department; of course, the totals of the two columns must balance. In the Office, also, are entered and carried out in their several lines the items shown, the manager filling in the "Percentage for Profit," or the estimated price, and the balance of profit or loss;

the former is omitted when estimates have been given, the latter when no estimate has been sent out. The manager signs the ticket, and it is passed to the ledger account, folio'd, and filed for instant reference, invaluable in case of future estimating, superseding the use of a cost book, and in case of any dispute as to the account; whilst it helps the manager in forming some idea of the prosperity or otherwise of the concern, constantly to have these records pass before him, and enables him to see whether too much time has been spent on any job, and to inquire into its cause in any one or more departments. In giving out, or in promising the work, it is an aid to deciding as to which job is most urgent, and every foreman sees what work lies before him, and as it is exhausted he requisitions more.

Having thus shown No. 1 ticket in its course, a glance at No. 2 will show its passage by a different route, the system being the same. In this case, the job goes from the Artist direct to the Litho department, instead of the Engraver, where proofing, offsets, and printing afterwards are done, instead of by the Letterpress, each item of work being charged in its proper place. In No. 3 this would be again reversed as to printing, but the transfer to zinc would be done in the Litho department, whilst the cost of biting-up would be entered, whether done in the house or outside, under Engravers' department—in the latter case, in the Office from the invoice sent in.

Enough has been said to explain a system which obtains in many of the largest printing concerns in London, and very widely in Paris and America. It is a great improvement on any other plan, and will amply repay any firm introducing it into their concern.

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NOTE.—Every employé should be furnished with a diary, in which to enter every hour to each job corresponding to the entries on the Work-tickets, and quoting the number of each. In making out his wages ticket from his diary under each day of the week, he should again quote the Work-ticket numbers, which identify the job, and render further particulars unnecessary.

*ORDER No. A00,001.* **WORK-TICKET.** *Date*.....189...

*M*.....

*Address*.....

*Description and Particulars*.....

.....

.....

**N.B.—No Work will be Paid for unless recorded on a Work-Ticket.**

Proof prom'sed..... .. Copies (when wanted).....

| | Hours. | Rate | £ | s. | d. | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| **ARTISTS.** Designing.....Sketching.....@ | | | | | | | | |
| Drawing, Wood or Stone .....@ | | | | | | | | |
| ,, Colour Blocks or Stones.....@ | | | | | | | | |
| ,, for Process .....@ | | | | | | | | |
| | Hours. | | | | | | | |
| **ENGRAVERS.** Wood (or) Copper-plate ..... .....@ | | | | | | | | |
| Square inches (Wood or Plate) .....@ | | | | | | | | |
| Other Material ..... .....@ | | | | | | | | |
| | Hours. | | | | | | | |
| **LITHO-DEPT.** Stone Polishing.....@ | | | | | | | | |
| Transferring.....Rolling-up.....@ | | | | | | | | |
| Proofing..... ... Pulls or Hours at Press .....@ | | | | | | | | |
| Runs at Machine (or Hours) .....@ | | | | | | | | |
| | Hours or piece @ | | | | | | | |
| **LETTER-PRESS DEPT.** Comps..... @ | | | | | | | | |
| Proofing.....hrs. Reading.....Correcting .....@ | | | | | | | | |
| Hours (or Pulls) at Press .....@ | | | | | | | | |
| Hours (or Runs) at Machine ..... ...@ | | | | | | | | |
| **STORES.** Boards or Cards .....@ | | | | | | | | |
| ..... Reams Paper. Weight.....Size.....@ | | | | | | | | |
| .....lbs. Ink .....do. Colour .....Varnish.....@ | | | | | | | | |
| Sundries.....Wrappers or Cases..... @ | | | | | | | | |
| **WAREHOUSE.** Cutting.....hours@ | | | | | | | | |
| Perforating..... Paging..... Eyeletting .....@ | | | | | | | | |
| Collating..... Wire Stitching..... Binding.....@ | | | | | | | | |
| Making up..... Packing.....@ | | | | | | | | |
| Sundries..... ..... Charges.....@ | | | | | | | | |
| **OFFICE.** Supervision, Commissions, &c. .....@ | | | | | | | | |
| Postages..... Petty Cash, &c..... Telegrams.....@ | | | | | | | | |
| Wear and tear of Plant at.....per cent. ..... | | | | | | | | |
| Working Expenses, Rent, Gas, Steam, &c. .....@ | | | | | | | | |
| *.....Percentage to be added for Profit ..... | | | | | | | | |
| Carriage or Delivery | | | | | | | | |
| ESTIMATE No..... Total | | | £ | | | | | |
| Estimated Price ..... | | | | | | | | |
| Signature of ..... } To Balance Profit (or Loss)..... | | | | | | | | |
| *Manager.* } Total Amount of Invoice ..... | | | £ | | | | | |
| Led. folio..... | | | | | | | | |

* *Not to be entered when Estimate has been furnished.*

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